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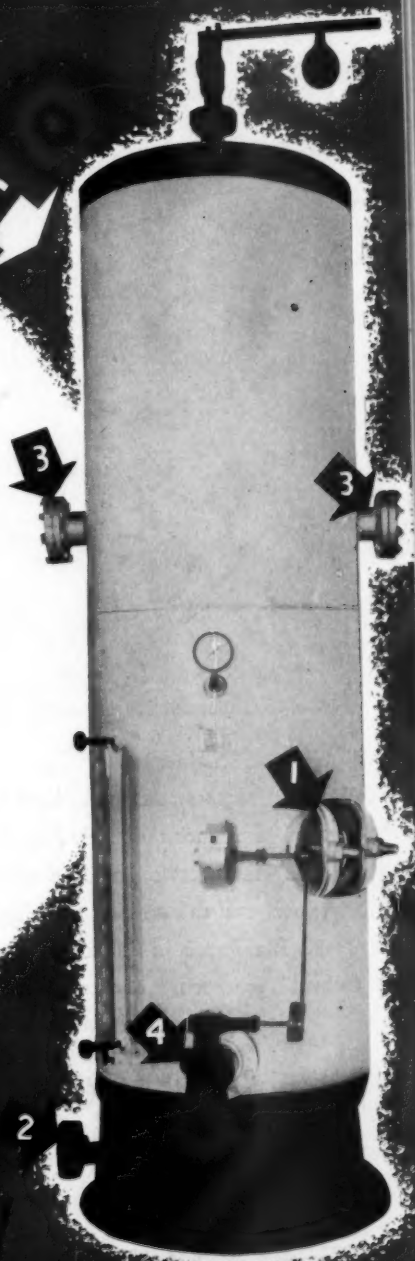


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*published weekly by the*

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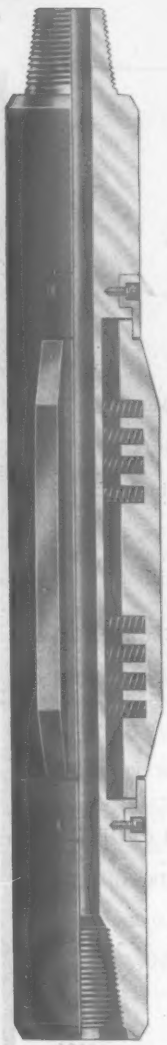
# SCRAPING CASING

## the follow-up step in well completion



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CASING SCRAPER

Unless the inside of your casing—the *working surface*—is smooth and clean, there is always a hazard of encountering difficulties in future down-hole operations. The use of a Baker Casing Scraper eliminates that hazard, for it effectively removes all obstructions from the inside of the casing, leaving it smooth and clean to its *full I.D.* The time to do a scraping job on your casing is while the equipment still is up and the crew still on hand. It's then a simple matter to include a Baker Casing Scraper in the string as a "follow-up" behind the bit when running-in to drill out cement. Thus, in one operation, it is possible to remove the hardened cement, scale, sharp burrs from gun-shot holes, or other obstructions which might later damage packers, swabs and similar tools.

### WHY PROGRESSIVE OPERATORS ARE USING THE BAKER ROTARY CASING SCRAPER

**MAY COST A LOT *NOT* TO RUN IT**—Damage to packers or swabs, plus delays and re-running expense can easily cost a lot more than the reasonable rental.

**MAKE SURE CASING IS CLEAN AND SMOOTH**—While the equipment is still up, and the crew on hand, scrape casing to leave it in perfect condition for future operations.

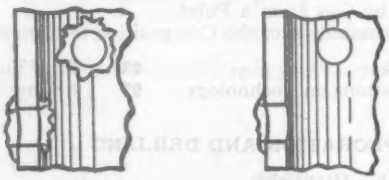
**MAKES FUTURE WORK SAFE AND EASY**—Leaves casing its full I.D., free from hardened cement or other obstructions which damage packers, swabs, bailers, other tools.

**EASILY USED BY *YOUR* CREWS**—Simply include Casing Scraper in the string when the bit is run to drill out cement.

**LOW-COST RENTAL**—Serviceman is not required, and the rental price is reasonable.

**REMOVES SHARP BURRS FROM GUN-SHOT HOLES**—The Baker Casing Scraper is strong enough to cut away all such obstructions which interfere with subsequent operations.

**REMOVES BURRS**



Before Scraping  After Scraping

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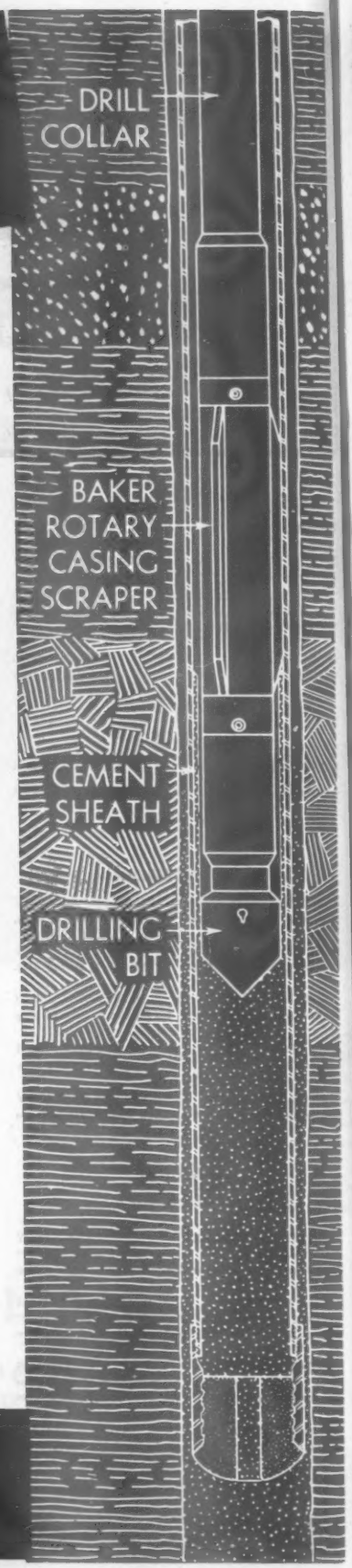



## BAKER OIL TOOLS, INC.

Houston—LOS ANGELES—New York

the OIL AND GAS JOURNAL

# Trends

Crude-Oil Production
By States—Page 122

**CRUDE-OIL STOCKS** 221,227,000 bbl. as of March 24—up 1,741,000 bbl. One year ago 236,285,000 bbl.

**GASOLINE STOCKS** 99,012,000 bbl. as of March 24—up 130,000 bbl. One year ago 85,583,000 bbl.

**RESIDUAL FUEL-OIL STOCKS** 43,327,000 bbl. as of March 24—down 391,000 bbl. One year ago 52,475,000 bbl.

**GAS OIL AND DISTILLATE STOCKS** 26,782,000 bbl. as of March 24—up 299,000 bbl. One year ago 30,925,000 bbl.

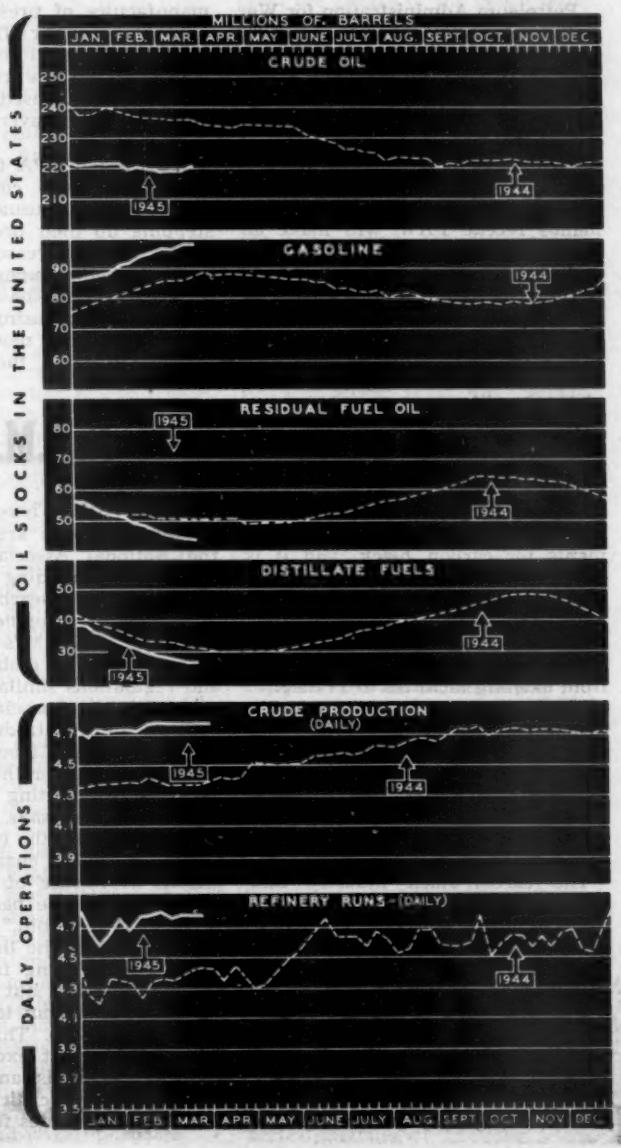
**CRUDE-OIL PRODUCTION** 4,776,900 bbl. as of March 31—down 5,400 bbl. One year ago 4,384,100 bbl.

**REFINERY RUNS** 4,742,000 bbl. daily week ended March 24—down 31,000 bbl. One year ago 4,466,000 bbl.

POSSIBILITY that prewar petroleum policies of certain European countries will be changed substantially in the postwar period looms as the German war nears an end and as governments and private oil operators consider plans. Planning is tied with monetary stabilization, credits, equipment, source of petroleum supplies and overall industrial policies. In this connection a French industrial commission, as reported in this publication last week, is in the United States in the interest of expansion in that country, involving petroleum refining and distribution. The commission is seeking immediately 30,000 to 35,000 bbl. daily of crude oil to start operating 4 or 5 refineries which suffered little or no war damage.

A LONG-RANGE policy for future refining is also under consideration by the commission, which has consulted with government representatives and officials of oil companies, most of which have refining and marketing properties in France or were formerly importers of petroleum products. At the start of the war France had 18 refineries, with a capacity of 150,000 bbl. daily, and in addition had a number of compounding and blending plants and large terminal facilities. Many of these plants and facilities were either largely destroyed before the German invasion or much of the equipment was moved to Germany after the invasion. Most of these plants were modern, but of small capacity. They were built by private owners in accordance with French petroleum laws, which forced companies desiring to distribute in France to have sufficient refinery capacity to take care of a large part of their domestic requirements.

THE question is now being raised as to whether this prewar policy should be continued and thus bring about the rebuilding of a number of these small plants. An alternative plan would be to change the policy and build a few large plants involving mergers among prewar operators. It is pointed out that the larger plants would require smaller capital expenditures with greater operating efficiency. It would also facilitate the use of pipe lines for the movement of products in France. It is said that similar plans are being discussed for other European countries. A rapid growth in pipeline transportation of products is predicted as a result of the war experience. Future national safety is involved.



# Carbon-Black Expansion Calls for $11,371,000 Outlay

WASHINGTON. — Fourteen steps to increase production of carbon black are announced by War Production Board, which has been aided in preparation of the program by the Inter-Agency Carbon Black Committee, of which Michael J. Leutch is chairman.

One step of particular importance is that of giving preference rating of AA-1 to all projects looking to expansion of carbon-black output. This is expected to increase productive capacity 188,100,000 lb. annually. Other steps agreed upon follow:

Petroleum Administration for War will make available daily 10,000 bbl. of naphtha and 2,000 bbl. of gasoline residue, adding about 1,500,000 lb. of carbon black monthly. PAW will make available also 115,000 gal. of propane gas daily at once, making it possible to increase carbon-black production 1,000,000 lb. monthly. As soon as heating demands recede PAW will make an additional 150,000 gal. of propane gas available daily.

The Railroad Commission of Texas is obtaining additional sources of gas for carbon-black plants in that state, permitting manufacture of 1,500,000 lb. of additional carbon black monthly.

War Manpower Commission has instructed regional and areas offices to give the carbon-black industry top labor priority.

Inter-Agency Carbon Black Committee is reviewing export requirements for carbon black, and it is expected 5,000,000 lb. per month may be diverted to the rubber manufacturing industry. The committee has requested the War Department to take steps to obtain carbon black from existing facilities in France.

The possibilities of producing carbon black in the Middle East are being investigated. Production in this country and Canada where sweet gas may be used is being pushed. In Louisiana other steps are being taken to permit use of sweet gas.

The carbon-black industry and government agencies are taking steps to make enriched gas available wherever possible, increasing production from existing facilities 40 per cent in some plants.

With the AA-1 preference rating, it will be possible for Defense Plant Corp. and Defense Supplies Corp. to expedite new facilities.

New pricing provisions allowing producers higher price ceilings for all rubber grades of channel carbon black made under emergency high-cost conditions and sold to DSC, a government agency, were announced last week by the Office of Price Administration.

This action, effective March 31, 1945, provides increases above the minimum required by law for the purpose of encouraging the maintenance and expansion of production, OPA said. Channel carbon black is used principally in the manufacture of synthetic rubber tires and tubes and is urgently needed at the present time for the manufacture of tires and tubes required in the war effort.

DSC will resell the channel carbon black to the rubber industry at a flat price, based upon the estimated weighted average acquisition cost.

WPB asked OPA to grant higher ceiling prices to compensate producers for the unusual expedients in stepping up their production.

The price increases, which will vary, depending upon the raw materials used, will be determined by each producer, using the formula set forth in the new pricing provisions. In brief, the formula (for all except new plants) permits the addition of current raw material cost per pound to specified conversion costs in effect during the first 6 months of 1944.

**CARBON BLACK EXPANSION PROJECTS**

**(Projects Approved and Granted AA-1 Preference Rating March 16, 1945) All Scheduled for Completion by October**

| Company and location— | Estimated costs |
|---|---|
| Cabot Carbon, Guymon, Okla. | $262,000 |
| Cabot Carbon, Borger, Tex. | 801,666 |
| Cabot Carbon, McCoy, La. | 1,040,000 |
| Cabot Carbon, Wickett, Tex. | 150,000 |
| Cities Service, Ector Co., Tex. | 224,000 |
| Cities Service, N. Cowden, Tex. | 150,000 |
| Columbian Carbon, Seagraves, Tex. | 55,595 |
| J. M. Huber, Inc., Borger, Tex. | 212,400 |
| Jefferson Lake Sulfur, Clemens, Tex. | 360,454 |
| C. E. Johnson, Eunice, N. M. | 2,825,000 |
| C. E. Johnson, Monument, N. M. | 410,000 |
| Phillips Pet., Borger, Tex. | 260,500 |
| Phillips Pet., Borger, Tex. | 119,310 |
| Phillips Pet., Goldsmith, Tex. | 53,000 |
| Phillips Pet., Eunice, N. M. | 142,826 |
| Roxboro Steel, Hardin, Tex. | 350,000 |
| United Carbon, Ryus, Kans. | 1,105,748 |
| United Carbon, Ryus, Kans. | 1,248,420 |
| United Carbon, Ector Co., Tex. | 158,621 |
| United Carbon, Foster field, Tex. | 139,000 |
| United Carbon, Midland, Tex. | 28,755 |
| United Carbon, Odessa, Tex. | 1,135,200 |
| United Carbon Judkins, Ector Co., Tex. | 139,475 |
| Total | $11,371,970 |

The above facilities represent 40 per cent of the expansions regarded as necessary to produce carbon black for maximum operation of the rubber manufacturing industry including all expansions. Complete list of new facilities will be announced in a few days.

# N.A.M. Endorses Patent Bills

NEW YORK.—Three bills now before Congress are endorsed by the National Association of Manufacturers, according to announcement by R. J. Dearborn, president of Texaco Development Corp. and chairman of N.A.M.'s committee on patents. The bills embody principles and regulations similar to those advocated by the association.

These bills, introduced by Rep. F. W. Boykin, Alabama, are H.R. 2632, providing for the recording of agreements relating to patents, which Dearborn says, would "bring into the open all the contract agreements on which charges and suspicions of misuse of patents have been based in the past." H.R. 2631 is the "20-year bill," which automatically limits the life of a patent to 20 years, dating from the time of its application, but provides that no patent shall run longer than 17 years after issue. This bill is designed to prevent excessively long application periods, an abuse which has called down criticism.

H.R. 2630 provides for public registration of patents available for licensing. The N.A.M. committee still opposes the suggestion that the commissioner of patents shall hold the power to fix terms and conditions of licenses, which authorization the Boykin bill proposes, a provision which would give the commissioner control over all patents.

## Frank B. Taylor Becomes Member of I.P.A.A. Staff

Frank B. Taylor, well known as an oil writer, has joined the staff of Independent Petroleum Association of America as editor of The Independent Monthly, with his office in the national headquarters of the association in Tulsa. Taylor went to Tulsa in 1936 from Texas, where he was engaged in natural-gas measurement and production for Panhandle Eastern Pipe Line Co. He recently disposed of his interest in Engineering Sales & Commerce Co. He is a past president of Engineers Club of Tulsa.

# Geophysicists Ponder Manpower At Fourth Wartime Conference

THE necessary annual business meeting and a regional conference of local members was combined by the Society of Exploration Geophysicists which held its fourth wartime conference in Tulsa April 4.

Discussions of manpower problems occupied a great part of the time of many members attending. Some estimated that they would have to cut down the number of field crews as much as 15 per cent, if deferments were curtailed as much as threatened in announcements from Washington.

It was announced that the society will establish a committee in each area to aid returning veterans of this war who are geophysicists and who wish to make new connections. Efforts will be made to assist them in obtaining placements where their highest skills can be utilized.

The regional committees that had been appointed to secure papers for publication that would help geophysicists in their war effort, announced that the greatest number of papers in the society's history had been offered for presentation and publication.

The society also voted to affiliate with the American Geological Institute, which is to act as a clearing house and center for all geological societies in matters of common interest. Dates for the next regional meetings were announced. The Houston meeting is to be held on April 20, and the Dallas meeting on May 3.

The retiring president, W. M. Rust, Jr., in his presidential address, warned that after the war there would probably be a flood of proposed new geophysical exploration methods and offered five criteria by which their potential usefulness could be tested. An extended digest of this address is published on page 62.

# Texas Pushing Gas Conservation

AUSTIN.—Development of a more comprehensive state-wide gas conservation program will be launched here April 13 at a conference of an industry advisory committee, an engineering committee and representatives of the Railroad Commission. W. J. Murray, Jr., chairman of the engineering committee, has completed organizational work and is prepared to start the study of oil fields in which gas is being flared, popped or wasted with a view to recommending methods by which it can be utilized.

The advisory committee, which will meet in Austin with the engineering committee, is composed of independent oil men and officials of the major oil companies. The independent and major companies have furnished personnel for the engineering committee.

"The cooperation extended by oil and gas companies means that the industry and the Railroad Commission will reduce wastage of natural gas to a minimum by the time this work is completed," said Beauford Jester, a member of the commission.

Features in the pending gas conservation bill are its provisions for pressure maintenance, the ratable take of gas, the reduction of amount of gas lift from 10,000 cu. ft. per barrel to 2,000 and 5,000 cu. ft. per barrel of oil, the providing of a floor of 2,000 and a ceiling of 10,000 cu. ft. on gas-oil ratio and the taking into consideration of casinghead gas in reallocation of gas that goes to market for heat and fuel. These last two provisions will curtail the venting and popping of gas in the oil fields and convert casinghead gas to profitable purposes.

This bill takes a modest step forward in requiring the cycling of wet gas containing liquid hydrocarbons. The bill defines as waste the failure to maintain pressure or to cycle gas in a reservoir that will yield as much as 1½ gal. of pentanes and heavier liquid hydrocarbons per 1,000 cu. ft.

To illustrate how the provisions of this gas conservation bill will enable the industries and the Railroad Commission to conserve natural gas: In January Texas oil fields produced 2,137,000 bbl. of crude oil daily and 2,600,000,000 cu. ft. of casinghead gas a day was used in the production of this oil. Only 1,000,000,000 cu. ft. of this gas went to gasoline plants and only 90,000,000 cu. ft. daily went to gas pipe lines. This bill will allow the Railroad Commission to put to use the remaining 1,510,000,000 cu. ft. of gas to be either used in repressuring the fields, run to gasoline plants, put it in pipe lines or diverted to other useful and lawful purposes.

## Socony-Vacuum Examines Its War Losses Abroad

NEW YORK.—Socony-Vacuum Oil Co., Inc., with foreign investments placed at $42,000,000, has been able to make a preliminary study of losses inflicted by the war. "The refinery at Naples," says the company's annual report, just made public, "is completely destroyed. Of the two refineries in France, one has been 60 per cent destroyed and the other damaged." No information has been obtained yet regarding refineries in Germany, Austria, Czechoslovakia, Hungary or Poland.

In Turkey, the Near East, North and West Africa, Portugal and Great Britain the company is in full operation. In continental Europe, however, the restoration of business, country by country, will depend upon the nature of the peace terms, the economic and financial policies of the United Nations and local governments and the measure of support afforded foreign trade by the United States Government.

With the liberation of France, Belgium, Greece, southern Italy, and Romania, the company has established contact with its organizations there, and American representatives are being sent to appraise the situation.

Socony-Vacuum's production in the Near East averaged 8,900 bbl. daily in 1944. Colombian Petroleum Co., owned jointly by Socony-Vacuum and The Texas Co., continued its production from the Petrolea field, and this was sufficient to finance development of a new producing area to the north. Socony-Vacuum's share in production from the Barco Concession was 6,500 bbl. daily. In the Magdalena Valley small production was found in two wells. Venezuela recently granted the company wide exploration permits.

## Guayule Subsidy Bill Approved in Committee

WASHINGTON.—The House Agriculture Committee last week reported favorably a bill to subsidize guayule as a means of building up a domestic source of natural rubber.

The bill, introduced by Rep. W. R. Poage of Texas, provides price supports, based upon 28 cents per pound for processed crude guayule rubber harvested before June 30, 1956. Guarantees to any grower in a single year would be limited to production from 40 acres or less, and the total subsidy program to 400,000 acres. The program would be under the direction of the Secretary of Agriculture, who would also be authorized to develop an extensive research program for experimentation in guayule.

# Immediate Threat Removed on Intangible Tax Chargeoff

*by Henry D. Ralph*

WASHINGTON. — The immediate threat to the oil-producing industry created by the Fifth Circuit Court decision banning the tax deduction of intangible drilling costs has been nullified by the announcement that the Bureau of Internal Revenue will not apply the decision for the present.

This means that there will be no change in the Treasury Department regulations giving a producer the option of deducting intangible drilling costs as current operating expenses or of capitalizing such costs, even though the circuit court said that this regulation is illegal.

However, the possibility remains that the bureau might later take a different view, because of a Supreme Court decision or other reason, and therefore the oil industry is expected to continue its campaign to have Congress write this option into the revenue laws. Additional bills for this purpose were introduced in the House last week.

The bureau's position was announced in a letter from Joseph D. Nunan, Jr., commissioner of internal revenue, to Wesley E. Disney, former Oklahoma congressman, who had inquired about the effects of the decision in the F.H.E. Oil Co. case. The commissioner wrote:

"The bureau proposes to continue to follow the provisions of Section 29.23 (m)-16 of Regulations 111, and corresponding provisions of prior regulations, notwithstanding decision in case of F.H.E. Oil Co. In the event of a clarification of the law impelling such a change, in no event would such a change be retroactive unless so directed by Congress."

Bureau officials explained that the F.H.E. case involved a so-called "turnkey" well, and that at the time it was drilled internal revenue regulations required that the cost of a turnkey well be capitalized. Present regulations permit the option to be applied to turnkey wells as well as those drilled under other types of contracts. Both the Tax Court and the Circuit Court of Appeals upheld the bureau's contention that the old regulation was valid as applied to the period when it was in force, but the circuit court went further and declared that the option has always been illegal as applied to any type of well.

Rep. Daniel A. Reed of New York, who previously introduced a bill to write the current regulation into the law, has revised the bill and reintroduced it (H.R. 2825) with a provision validating deductions taken for prior years. Rep. Frank Carlson of Kansas has introduced a similar bill in slightly different language (H.R. 2796). Both measures are pending before the committee on ways and means, and several members of Congress have attacked the F.H.E. decision and urged the enactment of legislation to affirm the legality and insure the permanence of the present regulations regarding intangible-drilling costs.

**THE CARLSON BILL (H.R. 2796)**

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, that section 23 (m) of the Internal Revenue Code is amended by adding the following at the end of the first paragraph thereof:

"1. All expenditures for wages, fuel, repairs, hauling, supplies, and so forth, incident and necessary for the drilling of wells and the preparation of wells for the production of oil or gas may, at the option of the taxpayer, be deducted from gross income as expense or charged to capital account.

"2. In addition to the foregoing option, the cost of drilling nonproductive wells at the option of the taxpayer may be deducted from gross income for the year in which the taxpayer completes such a well or be charged to capital account returnable through depletion as in the case of productive wells.

"3. The Commissioner of Internal Revenue, with the approval of the Secretary of the Treasury, is authorized to make such regulations as are necessary to effect the purposes of this Act and such regulations as have been heretofore issued by the Commissioner in response to section 23 (m) of the Internal Revenue Code and the sections of the law amended by section 23 (m) of the code are hereby recognized."

**THE REED BILL (H.R. 2825)**

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, that section 23 (m) of the Internal Revenue Code is amended by adding the following at the end of the first paragraph thereof:

"All expenditures for wages, fuel, repairs, hauling, supplies, and so forth, incident to and necessary for the drilling of wells and the preparation of wells for the production of oil or gas may, at the option of the taxpayer, be deducted from gross income as an expense or charged to capital account. In addition to the foregoing option, the cost of drilling nonproductive wells at the option of the taxpayer may be deducted from gross income for the year in which the taxpayer completes such a well or be charged to capital account returnable through depletion as in the case of productive wells."

**Sec. 2. Effective Date**

(a) Taxable Years Beginning After December 31, 1944.—The amendment made by section 1 shall be applied to all taxable years beginning after December 31, 1944, but shall not be deemed to grant a new option to any taxpayer who has exercised an option in accordance with regulations in force prior to the enactment of this Act.

(b) Taxable Years Beginning Prior to January 1, 1945.—If, in computing income and profits taxes for any taxable year beginning prior to January 1, 1945, the taxpayer deducted intangible drilling and development costs from gross income as an expense and such deduction was taken in accordance with an option granted under regulations then in force, such deduction shall be deemed to be allowable under the law applicable to such taxable year.

# General Depletion Committee Meets

ST. LOUIS. — Forty-odd members of the petroleum industry's general depletion committee met here this week to discuss legislation already introduced and that proposed for clarifying the tax law on deduction of intangible drilling costs as an operating expense.

Two days, April 4 and 5, were devoted to the discussion. It was pointed out that none of the bills already introduced in Congress has the official approval of the industry's depletion committee. Representatives who promptly introduced bills to offset the damage of the Fifth Circuit Court decision in the F. H. E. Oil Co. case were commended, however, for their constructive interest manifested by their actions. The internal revenue commissioner's decision to continue existing regulations, pending clarification of the law and results of an appeal for rehearing of the F. H. E. case and considered by some depletion committeemen as only a temporary reprieve from the Circuit Court opinion. Permanent relief, many asserted, can be assured only by correcting deficiencies of the tax law itself.

Many members of the depletion committee arrived in St. Louis from Tulsa where they had spent several days perfecting a brief asking for rehearing of the F. H. E. case in the Fifth Circuit Court. The brief is scheduled for filing not later than April 10.

# THIS WEEK

**REFINING**—Work rushed on plants in Calcasieu Parish, Louisiana, and Borger, Tex., to make toluene for high explosives needed by Army. . . . Government condemns 343-acre tract in Calcasieu for immediate construction of another toluene plant. . . . ¶PAW asks governors of 48 states to help assure kerosene and heating oil for next winter by suspending local regulations that hamper production and distribution. . . .

**NATURAL GAS**— Conflicting views obstructing any gas-conservation bill in Texas apparently resolved by compromise measure. . . . Major oil companies agree to provisions requiring them to deliver casinghead gas to reasonably accessible pipe line. . . . Estimated waste of billion feet daily would be eliminated. . . . ¶FPC's decision to postpone hearings in nation-wide investigation of gas reserves and conservation gratifies official Louisiana. . . . Gives more time to get facts accruing to state's advantage. . . . ¶Cunningham, Kans., plant produces in first year twice as much helium as world output in any prewar year. . . .

**PRODUCTION**— Pryor & Lockhart, Inc., independent producing concern, Wichita, Kans., bought by National Cooperative Refinery Association. . . . First instance of outright purchase of producing company by cooperatives. . . . Transaction gives cooperatives working interest in 46 additional producers. . . . ¶Nation's daily crude output 4,776,900 bbl. . . . Decrease of 5,400. . . . Oklahoma's production, 372,950 bbl. highest since September 1942. . . . West Edmond doing 66,000 daily. . . .

**ECONOMICS**—Internal Revenue Bureau decides oil companies may continue to deduct intangible drilling expenses for income-tax purposes, notwithstanding federal court ruling to contrary. . . . Clarification by court or Congress declared imperative. . . . Members of Congress planning legislation designed to nullify court's opinion. . . . ¶Texas Supreme Court rules river beds are not submerged lands. . . . If legislature had so intended, it would have said so. . . . ¶If world is to reap benefits of petroleum after war, artificial barriers must not be erected by governments to prevent men from seeking oil wherever it may be found and profiting from discoveries, President Boyd, of A.P.I., tells West Coast oil men. . . .

**CARBON BLACK**—WPB assigns top priority to all pending carbon-black projects. . . . Will add 188,100,000 lb. to yearly production capacity, aiding substantially in alleviation of tire shortage. . . . Also announces 14 steps designed to boost carbon-black output. . . . ¶OPA helps by authorizing adjustable prices for sales to DSC of non-specialty black produced from propane. . . .

**WAR**— American and British war planes bomb last big synthetic-oil plant still active in Germany. . . . ¶Allied commanders say no danger of further gasoline shortage. . . . "If we never get another drop, we shall have enough to take us right into Berlin." . . . ¶PAW says German collapse will mean increase of perhaps 50 per cent in civilian gasoline rations. . . .

**PRICES**— Bill extending Price Control Act 1 year referred to subcommittee of Senate banking and currency committee for study. . . . Expected amendments include one on depletion. . . . ¶OPA rules that holders of excess stocks of tubular goods may add to resale price the cost of transportation from nearest railroad siding to place where goods are stored. . . .

**LEGISLATION**— Texas house committee reports favorably 5-4 on bill prohibiting use of public highways for geophysical exploration. . . . Action followed sharp debate whether oil companies hold up farmer, or vice versa. . . . ¶Texas considering bill to minimize gas waste. . . .

***These pictures explain in part the increased production that has be n reported from the Illinois basin during the past 2 or 3 weeks. Subsidence of flood waters from the Wabash River, which have h mpered operations this spring, has permitted resumption of normal production. These pictures show the same well on a Carter Oil Co. lease in the East Inman field, Gallatin County, Illinois, during normal conditions and while floodwaters submerged the pumping engine***

# Electrical Logging Widely Employed In Rocky Mountain Exploratory Tests

**by Charles J. Deegan**

THE lack of salinity in the connate waters of Rocky Mountain oil fields has been noted in a previous article, in connection with the "flushing theory," which attempted to explain the lack of oil accumulation in some structures. Whether the flushing theory is accepted or rejected, there is one phase of exploration work in which this lack of salinity must be taken into account, namely electric logging.

**This third and final article on recent Rocky Mountain exploration, discusses the problems of electrical logging and gives a brief outline of a new theory on the regional structural accumulation of oil. Parts 1 and 2 of this series appeared in the issues of March 10, page 41, and March 17, page 58.**

### Electrical Logging Problems

Electrical logging was introduced in the Rocky Mountains in 1936. Since that time rapid progress has been made, and today an electrical log is taken in nearly all of the wells drilled. It is used both for correlation and interpretation of fluid content.

Such a log, in this territory, presents an unusual pattern, which leads to many disappointments if geologists and engineers attempt to compare it with the well-known patterns found in the Gulf Coast and Mid-Continent. Actually this unusual pattern prevails precisely because of certain unique characteristics of the formations encountered in the Rocky Mountain area, i.e., fresh formation waters, rapid lithologic changes, and low permeabilities.

Because of the fresh formation water, little self-potential is found on the log. This is due to the similarity in salt content between the mud used in the hole and the water in the formation, making a weak cell for the electrochemical potential. If very fresh mud is used, good self-potential is found. Unfortunately, this is difficult to get, first because the supply waters are often strongly alkaline; second, because of the mud contamination occurring during the drilling in the red beds.

The resistivities found on the logs are often great because fresh formation waters make poor electrolytes for conduction of the current. When little porosity is present in the formation, very large resistivities are read, and this occurs often in the Paleozoic series. As a result producing sections give a somewhat lower resistivity than the nonporous materials adjacent to them.

All of these conditions make visual interpretation of electrical logs difficult. Fortunately, calculation methods have been developed that permit evaluation of the water saturation in the formation. Such calculations are now routine among those accustomed to handling electrical logs in this area. These calculations not only permit interpretation of the fluid content but are also a valuable help in estimating reserves.

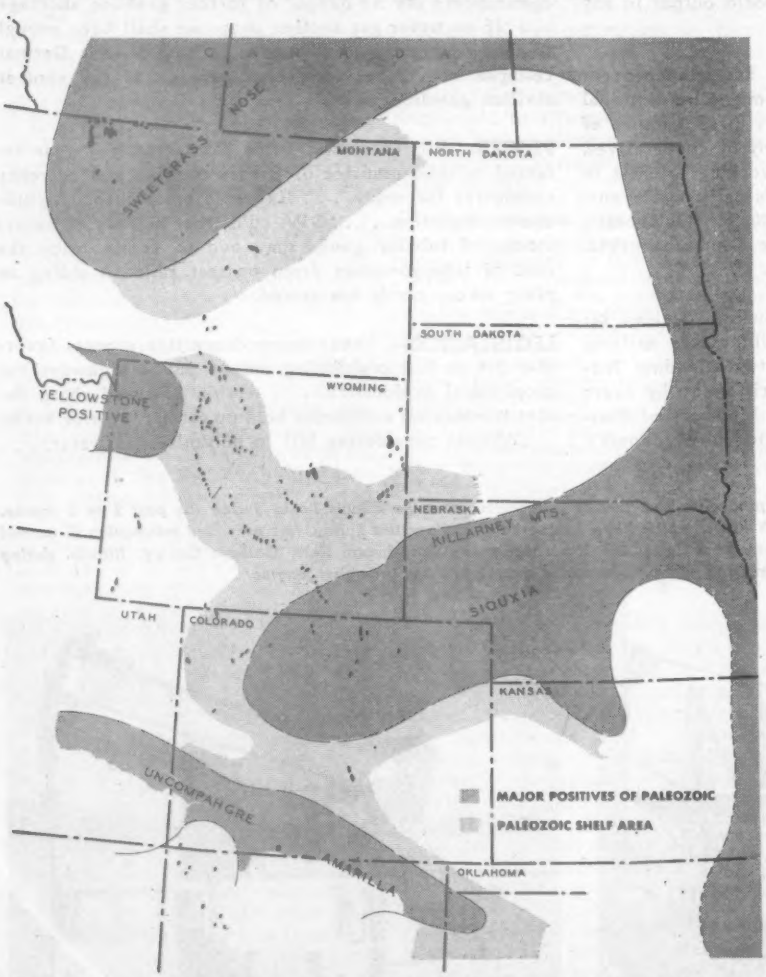



*Fig. 1: Generalized paleogeological outline of Paleozoic positive areas in Rocky Mountain region that controlled sedimentation, pre-Cretaceous oil accumulation, and formation of mountain ranges*

### Permeability and Water Shutoffs

One result of the low permeability common in all sections is that the water saturation is relatively great, even in the producing horizons. For this reason, there frequently is no sharp line of demarcation between the zones of oil saturation

and the water-bearing zone. In some cases the combination of low permeability and heavy oil appears to result in a fairly thick zone of transition between the oil and water. Some wells completed in this transition zone produce both oil and water from the very beginning, and a water shutoff, leaving clean oil production, is impossible. The amount of water saturation calculated from the electric log will determine whether or not a well has entered the transition zone. This knowledge is very important in the completion of the well.

### New Geological Ideas on Structure

With the revival of the exploration play, there is renewed interest in the problem of why some structures produce oil, when others, with apparently equally favorable conditions, yield only dry holes. With larger budgets and more manpower available, the regional geological departments have been attacking these problems, gathering data and applying some of the newer techniques and concepts of geological thinking. This work has been so recent that little has been published on it.

One of the new concepts concerns the tectonic features that controlled structure building and traps for oil accumulation. Followers of this school hold that the present tectonic aspects of the region are misleading, certainly as to prospects for Paleozoic production, and probably even for most post-Paleozoic production.

They hold that the present tectonic picture is largely post-Cretaceous in origin, whereas only by going back to the "major positives" of Paleozoic time, can the general tectonic pattern of favorable structures be located. Such a picture is shown in Fig. 1.

This map shows a general outline of the major positive areas that persisted throughout Paleozoic time, either as land masses, or partly as land mass and partly covered by shallow seas, or, if ever wholly submerged during any part of the Paleozoic, covered only by very shallow seas. These major positives, according to this school, absolutely controlled sedimentation, formation of mountain ranges, and the structural conditions where Paleozoic oil fields can be found.

Structures must have been formed along the "shelf area" of relatively shallow seas, adjacent to and roughly parallel with the positive areas, and on the oscillating flanks of the positive features. Such structures could contain Paleozoic oil, whereas structures having their origin in post-Paleozoic time could hardly be expected to produce any Paleozoic oil (except in a very few abnormal cases), since no structure existed when the oil was formed.

These geologists also contend that the chances of finding Jurassic, Cretaceous, and possibly Tertiary oil, are much better in structures that were formed in Paleozoic times, since the geologist can be reasonably sure that favorable structural conditions for trapping oil were in existence at all times during the deposition of the formations that are expected to contain the oil.

Followers of this school do not rule out the possibility of finding post-Paleozoic oil in structures that are post-Paleozoic in origin. They do maintain that there was a much better chance of trapping such oil in a structure that was in existence before the oil was formed.

Obviously the picture of the areas considered by this school as favorable for oil accumulation will differ considerably in places from the conventional picture based on post-Cretaceous tectonics. The conventional picture was shown on the map with the second article of this series. (See The Oil and Gas Journal, March 17, 1945, page 60.) It divides Wyoming, for example, into a series of basins, the Big Horn, Wind River-Shirley, Washakie, Powder River, etc.

### Prospects Best on Shelf Area

The new school holds that the prospects are best on the shelf area, off the major positives (Fig. 1), in structures that have their axis of folding approximately parallel with the nearest major positive. Such structures will usually be of Paleozoic origin.

This shelf area, as will be seen in Fig. 1, is shaped roughly like a Y lying on its side, with the base in the west corner of South Dakota-Nebraska. The fork of the Y begins about the center of Wyoming, with the north branch angling northwest and curling around the Yellowstone positive in a manner almost duplicating the area of the existing Big Horn basin. The south branch of the Y turns down from central Wyoming, heads into Colorado, and then curls back slightly toward the east again, passing between the two positive areas labeled "Siouxia" and "Uncompahgre." Another shelf area lies along the south and east sides of the Sweetgrass Nose, in Montana.

Time and the wildcatter will prove or disprove this new concept. If it is correct, tests on structures along the shelf area with an axis indicating Paleozoic origin should yield a high percentage of discoveries while wildcats on structures of post-Paleozoic origin should be less successful.

### Geological Literature

The literature on the various phases of petroleum geology in the Rocky Mountain region is voluminous and dates back many years. A representative and comprehensive bibliography is beyond the scope of this article. However, in recent years several important papers have been written on various phases of these problems, in which much of the available information was either summarized, classified, or tabulated. Each of these particular papers contains many references to the earlier literature.

The accompanying bibliography is a partial list of these more recent papers, selected in accordance with the phase of the subject involved. Use of it may simplify search of existing literature on Rocky Mountain geology.

### Bibliography on Rocky Mountain Geology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"Stratigraphy Versus Structure in Rocky Mountain Region," Ross L. Heaton, A.A.P.G. Bull., Vol. 21, No. 10, October 1937.

**Chemical.**—"Occurrences and Types of Crude Oils in Rocky Mountain Region," J. G. Crawford and R. M. Larsen, A.A.P.G. Bull., Vol. 27, No. 10, October 1943.

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"Oil-Field Waters of Wyoming and Their Relation to Geological Formations," J. G. Crawford, A.A.P.G. Bull., Vol. 24, No. 7, July 1940.

**Crude-oil analyses.**—"Crude Oil Analyses, Rocky Mountain Fields." Mimeographed tabulations, originally issued in 1940 by U.S.G.S., Casper, Wyo. Supplemental data added intermittently by same source, in form of mimeographed sheets.


## Mississippi Moves to Save Natural Gas From Waste

JACKSON. — With Mississippi's natural-gas reserves rapidly expanding, the state's Oil and Gas Board has announced that a public hearing will be held May 1 to obtain information as to what steps should be taken to prevent waste and to direct production and use of this gas into the proper channels. The hearing is expected to determine whether any waste of oil, gas or condensate is taking place now or is imminent, with special reference to the Carthage Point, Cranfield, Baxterville, Gwinville, Hub and Soso fields.

Producers in these fields are receiving by mail from the board questionnaires which are to be filled out, providing information which is expected to afford a basis for action. Each producer is asked to present at the hearing his suggestion for rules, regulations and orders to govern orderly development.

# Evaluation of New Geophysical Methods

***by W. M. Rust, Jr.****

**This digest of the president's address delivered by W. M. Rust, Jr., Houston, before the annual meeting of the Society of Exploration Geophysicists in Tulsa April 4 suggests five tests for evaluating new methods which will be proposed in flood proportions after the war ends. He expects improvements in instruments and techniques to be helpful in achieving greater efficiency but looks for advances in the thinking by geophysicists to be even more important.**

IN looking forward to the day when we can turn away from wartime activities, my interest has been rekindled in the problem of evaluating new geophysical prospecting procedures and modifications of old ones. At the moment there is a dearth of proposed methods, sound or unsound. The causes of this scarcity are well known and will end with the war. The war has dammed, but not dried up, the stream of oil finders' dreams. After the war we can expect a flood of proposed new methods and modifications of old ones.

When this flood comes we shall be faced with the twofold problem of recognizing and adopting proposals of real merit, while condemning the others with the least possible expenditure of money and effort.

Let me name five criteria which a usable geophysical prospecting method must satisfy. The first three are fairly simple to apply and will dispose of a high percentage of the crackpots. The last two, which are intimately related, require skill, patience, and a touch of clairvoyance, to apply with certainty.

### Test No. 1

The first criterion, that the method be based on physical measurements of some property of the earth, seems one that could cause little argument. I would like to extend this to require that the physical property involved be identifiable, but under extraordinary conditions, I may be willing to waive this, and insist only that a definite series of manipulations, leading to a numerical result be followed. If I can be convinced that the resultant numerical reading is actually a function of the location where the measurements are made, and satisfies my second criterion, I may grudgingly admit that it is a measurement of some unidentified property of the earth.

### Test No. 2

The second criterion is that the measurement must give reproducible results. If we have a device which meets Test No. 1 in giving physical measurements, it is of no value unless the elementary data which it gives at a series of stations can be repeated with a sufficiently high degree of accuracy, or unless repeatable secondary values can be obtained from these data by straightforward computations calling for a minimum of personal judgment.

By a sufficiently high degree of accuracy we mean that the error in repetition at an individual station must be a fairly small fraction of the difference between values at stations on and off the anomaly. Not only must the measurement at individual stations be reproducible, but the anomalies obtained by occupying two different, but overlapping, sets of stations should practically coincide. The variations observed over an area interpreted as indicating an oil field should be much greater than the variations observed when the same number of stations are crowded into any small portion of the area.

### Test No. 3

The third criterion is that the method must be economically competitive with existing ones. It must give more valuable results than other methods of comparable cost. This can be true if it finds oil not found by other methods, even though it may fail to find some oil they can find.

### Test No. 4

The fourth criterion is that the method must give information significantly related to the occurrence of oil, and this will be difficult to apply. I admit that a method gives information "significantly related" to the occurrence of oil, if it finds oil when used to guide a program of leasing and drilling with the same intelligence and confidence that are exercised in reflection seismograph work.

There are two approaches to the application of this criterion, the theoretical and the empirical. If the theory of the method is well developed, and if the numerical data on the variation of the relevant physical properties on and off anomalies are available, and if the calculations can be carried out without introducing approximations which vitiate the conclusions, it is possible to give a mathematical "Yes" or "No." These are three substantial "ifs."

The second approach is the empirical and statistical. A thorough empirical study is a long and costly process. One of the most important steps is selection of the types of areas and actual areas to be studied. Suppose the first tests of reflection seismograph had been in certain parts of West Texas or that the early refraction and gravitational work had not been in salt-dome country.

Both physical and psychological factors conspire to detract from the values of tests in areas occupied by oil fields, and to a lesser extent in areas condemned by dry holes.

Another system is to work fairly large areas around locations of wildcat wells which are to be drilled in the near future. This avoids most of the difficulties of testing in known oil-field areas or known dry-hole territory, but it requires more time and is feasible only for very promising methods.

A third system, technically the most desirable, but very expensive if the proposed method turns out to be unsound, is to select a number of rather large areas, prospect them with the proposed method and then drill the anomalies. The main disadvantage is that if the method fails in the first area tried, it is likely to be condemned, even though it might have succeeded in the next area.

Whatever procedure is used in empirical valuation of a proposed method, there is grave danger of demanding an unnecessary degree of perfection. According to Dr. Frederick H. Lahee, of 596 wildcats drilled primarily on seismograph data in 1943, only 123 were producers. Therefore, a new method which gave one discovery out of each five wildcats might be a serious competitor of the seismograph.

### Test No. 5

The fifth criterion is that the method must have a teachable interpretation. This means that it must be possible for a trained interpreter to derive from the primary data information usable in the search for oil. The process used in deriving this information may be one that will require intelligence, experience, and judgment, but not guesses or arbitrary choices.

*President, S.E.G.

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BY PATRICK C. BOYLE

the OIL AND GAS JOURNAL

# Future Rationing

THE announcement of Deputy Administrator Davies that the rationing of gasoline to civilians after V-E day will probably be eased 50 per cent should mark the end of an ambiguous policy in regard to the future nonwar use of petroleum products. There has been too much hush-hush as to the civilian's position in petroleum supplies, with the result that millions of customers are inclined to discount official explanations—a condition which serves neither this industry nor the future economy of this country.

Assuming that what has been done has served the war effort, there appears to be no sound reasons why, after peace in Europe, secrecy as regards petroleum should not be largely lifted. Certainly civilians are entitled to full information in a matter so vital to them during a reconversion period which will get under way in several directions as soon as Germany capitulates.

Apropos of this situation, one hears in Washington that present gasoline rationing should be continued until final victory in order to conserve cars and rubber, along with the more equivocal objective of maintaining a war spirit among civilians. No postwar planning could be more shortsighted or more ridiculous.

So far as rubber is concerned, with a record production civilian supplies can be quickly expanded as war requirements ease. As to cars, the owners, rather than a war agency, are the best judge of how these should be operated. There can be no effective reconversion in many phases of our economic life until the family car returns to general use. As to the war, the great majority of civilians, given the opportunity, will demonstrate that the maximum support comes with the freedom to act normally, not through restrictions which have served their purpose.

Then there is the argument that prolonged governmental oil controls will be necessary in order to maintain a balance between supplies and demands. We can't allow gasoline production to be expanded, it is contended, because there will be no place in world markets to go with other products or vice versa. This contention is even weaker than the others.

This industry, because of additional developments in refinery processing, has a flexibility in volume and quality of products which make it largely independent of long-range changes and temporary variations in market requirements. The extent of flexibility was readily apparent from a study of the process section of this publication's Refinery Number last week. The refiner, armed with the new tool of catalysis and minus operating controls and price ceilings, will level off market demand hills and valleys of the future.

In regard to distribution, the marketing departments of oil companies, thousands of jobbers and tens of thousands of dealers are prepared to expand their services as needed. For the immediate future this expansion will require little additional manpower or materials. Transportation conditions will improve when the war is confined to one theater.

Thus the only excuse for future petroleum rationing can be a scarcity of products after war demands have been met. Frankness in the discussion of these and allied matters will assure complete cooperation from the industry and its customers in whatever has to be done to assure and expedite final victory.

# California A.P.I. Meet Hears Discussion of Demand, Reserves

***by L. P. Stockman***

LOS ANGELES. — The Wartime Conference of the American Petroleum Institute, Pacific Coast district, Division of Production, held here March 29 represented a well balanced and practical program devoted primarily to drilling and production activities. Technical papers were presented at an all-day session followed by a banquet in the evening. Guest speakers were Ralph K. Davies, deputy petroleum administrator, and William R. Boyd, Jr., president of A.P.I. and chairman of Petroleum Industry War Council.

Basil P. Kantzer, Union Oil Co., was unanimously elected chairman of the Pacific Coast district, succeeding George Suman of Tide Water Associated Oil Co., who has been serving by appointment since the death of William Jarvis of The Texas Co. Lot Bowen, Western Gulf Oil Co., was elected chairman of Los Angeles basin district, succeeding W. J. Larson of Union Oil Co.; and Paul E. Lehr of Shell Oil Co., Inc. was reelected chairman of the San Joaquin Valley district. F. W. Hertel of Tide Water Associated Oil Co. was elected chairman of the coastal district and W. G. Corey, secretary-treasurer, was reelected.

One of the highlights of the meeting was an illustrated discussion by Ralph J. Schilthuis, assistant director, PAW production division, covering production, demand, and reserves of the United States. His data brought out the fact that demand during 1946 will be approximately the same as at present, 5,000,000 bbl. per day. Gen. Walter B. Pyron, who is in California making a survey for the Army and Navy staff, confirmed the demand estimate and stressed the need for higher production in California. Schilthuis placed the U. S. Reserves at approximately 20,000,000,000 bbl. and of the World reserve of 50,000,000,000 bbl. estimated that South America contained about 13 per cent, Russia 11 per cent and the Middle and Far East about 31 per cent. Because the U. S. as a whole is producing above the maximum efficient rate, the country is drawing on reserves to a substantial amount, now that the above-ground stocks have been or will shortly be below minimum requirements. Schilthuis estimated that if all drilling had been stopped at the close of 1941, the efficient productive capacity would have declined 30,000 bbl. daily by the end of 1942 and by 650,000 bbl. per day by the end of 1944. Continued drilling has not only absorbed this normal decline but stepped up production to its present high level. It was also brought out that two-thirds of current crude-oil reserves are contained in about 90 fields capable of producing 100,000,000 bbl. or more each and that of this group of 90 fields, 26 are in California.

The paper on performance of multizone wells in the Wilmington field, prepared by Read Winterburn of Union Pacific Railroad, and Carlton Beal of Richfield Oil Co., stimulated debate and discussion. James Dean, General Petroleum Corp., criticized operators for drilling multizone wells at Wilmington and claimed the multitude of troubles confronting Wilmington operators can be attributed to wells that have been completed in two or more zones. Packer failures on tubing and casing together with sand trouble is necessitating extensive remedial work. The discussion attempted to show that more oil would have been recovered if single zone wells had been drilled instead of the multizone completions and that it would have only required 1½ times as much critical steel. Gas caps have developed in several multizone wells, resulting in high gas-oil ratios, and this started another lively discussion as to where the bottom of the tubing was. Remedial work on gas-cap wells and in wells that have shown increasing water cuts, has been successfully accomplished in wells that were originally finished with blank liners. In holes where the upper Terminal zone has been left open except for packers above the zone the problem is difficult. Work at Wilmington is difficult because of the various producing segments. There are now 14 separate pools at Wilmington resulting from complex faulting and as far as known there is no migration of oil or gas from one pool to another, each segment being adequately closed by block faulting.

*E. A. Pellegrin, Macco Construction Co., chairman of the ticket committee; Basil Kantzer, Union Oil Co., new chairman of the Pacific Coast district; Williard Goertz, Axelson Manufacturing Co., chairman of arrangements, and George Suman, Tide Water Associated Oil Co., chairman of the Pacific Coast advisory committee*

### Paper on Oil-Well Casing

The paper on oil well casing failures by R. J. Kettenburg of Shell Oil Co., Inc. was another that resulted in extensive discussion. Casing failures at Ventura Avenue and Paloma came in for extensive discussion at the technical session and reached the point where Carl A. Young announced that the national committee was attempting to develop a reason for the failures which have occurred not only in California but in the Gulf Coast area as well. There are widely varied opinions on causes of casing failures. The problem is receiving attention from committees which hope to complete suggestions in May at which time the standardization committee may be called into session. In many cases the failures have been along the length of the pipe although in 372 tests under pressure 24 per cent of the collars leaked, principally between 5,000 ft. and 6,000 ft. where 61 per cent of the leaking collars failed.

Davies, speaking at the evening session following dinner, outlined many of the important and pressing problems of industry and government. He mentioned this was the first time since 1938 that he had the

privilege of addressing the Pacific section of A.P.I. and compared conditions with those of today. In 1938 the California oil industry was wrestling with overproduction. Today the problem is reversed with the industry trying to produce enough to meet the demand. The state's present crude-oil production is 44 per cent above prewar output while the remainder of the country is producing only 26 per cent above normal. To meet demands of the Pacific war theater, California is supplying 42 per cent while the Caribbean area is supplying 28 per cent and inland and Gulf Coast areas are supplying 14 per cent. A total of 2 per cent is supplied by Peru and 14 per cent by the Persian Gulf. At present 110,000 bbl. per day is moving from Texas to California and plans call for additional transfers.

There appeared to be a veiled threat in Davies' suggestion that the Coalinga Nose, Rio Bravo and Greeley fields should be brought under unit operation because a short time later he indicated PAW had not exerted any of its powers but would do so if necessary. With respect to the International Petroleum Agreement, Davies said:

### Difference Reconciled

"The difference between the Government and industry have been well reconciled in the second draft. The only obstacle at the moment centers about the inclusion of an antitrust immunity clause giving industry fair treatment in relation to the antitrust laws. In essence it provides that when the industry acts in concert in carrying out a Government-approved plan, it shall not thereafter be prosecuted for its acts. It cannot say what the outcome will be, but I remain decidedly hopeful."

The science of hydrocarbon chemistry, energized by the war, undoubtedly contains the seeds from which many new industries will spring up in this country after the war, Boyd told West Coast oil men.

The blueprint of what "the magic towers of petroleum" will mean to the United States of tomorrow and what they could mean to tomorrow's world is clear and simple, Boyd said.

"To reap the benefits of petroleum, the way must be cleared and kept cleared to produce it, to process it, to transport it and to distribute it. The path must be kept open for constructive competition between men and organizations to the end that each man's mind is whetted against the other man's abilities.

"If the world wants petroleum, artificial barriers must not be erected by governments to prevent men from seeking it wherever it may be found, and from profiting from their discoveries."

Vernon B. Zacher, test engineer with Tide Water Associated Oil Co., Ventura, Calif., presented a paper on "Field Testing of Drilling Muds." This paper treated some aspects of instruments and methods used in mud testing and control as applied at drilling rigs. Various mud problems are discussed, i.e., their relations to drilling operations, etc. Some treatments are not new, but they are included in the interest of completeness.

### Reservoir Fluid Flow Research

Norris Johnston, physicist for General Petroleum Corp. of California, and N. van Wingen, chief evaluation engineer for Richfield Oil Corp., both of Los Angeles, presented a paper on "Reservoir Fluid Flow Research." It reviewed the literature pertaining to the flow of fluids in reservoirs, and suggested experiments which remain to be performed before a reasonably complete understanding of reservoir behavior may be had. For future flow research, laboratory techniques are suggested, with special emphasis on experimental conditions to be avoided. Finally, certain types of tests and ranges of variables pertinent to California reservoirs were suggested.

R. H. Zinszer, Union Oil Co. of California, Orcutt, Calif., speaking on "Heavy-Oil Viscosimetry and Its Application to Production Problems" discussed methods of measuring the viscosities of extremely heavy crude oils, and presented results of tests in tabular and diagrammatic form. It also debates further experiments for the determination of pressure drops in oil-well pumps, the effects of high viscosity on surface horsepower, and oil-well pump efficiencies.

Carl Tutschulte, district production engineer, Tide Water Associated Oil Co., Los Nietos, Calif., discussed "The Performance of Gas Lift Through Small Tubing," giving results of an analysis of gas lift through "macaroni" tubing. Individual well-behavior characteristics were compared. The application of the conclusions derived from the test data to the design of any gas-lift system using macaroni tubing was discussed. A series of charts illustrating these general relationships was included in the hope that they may be of use in the application of this method of gas lift to other wells.

Problems in drilling to 16,246 ft., which gave California the well-depth record for a time in 1944, were outlined by Omar A. Cavins, assistant general superintendent of production in the northern district for Standard Oil Co. of California. He commented on performance of equipment and reported several lessons learned in coping with deep-drilling problems.

## Court Refuses to Dismiss Suit Against Standard

NEW YORK.—Supreme Court Justice Bernard L. Shientag last week denied a motion by Standard Oil Co. (New Jersey) to dismiss a suit filed by a majority stockholder alleging domination and control of a subsidiary company.

The plaintiff, Raymond B. Price, averred Creole Petroleum Corp., a subsidiary, had suffered financial loss and other detriments through domination.

Justice Shientag ruled the complaint contained "assertions of fact tending to support, to explain and give legal vitality to the conclusory allegations." His opinion added that Price was holder of 11,400 Creole shares and also was named defendant in the derivative stockholder's action.

The court said Standard Oil was charged with having failed to observe its legal duty as a majority stockholder of Creole by selling the firm's products principally to Standard Oil or other subsidiaries "at unfair and inadequate prices and substantially less than the known market prices for such products."

The suit sought a judgment directing Standard Oil to account for and pay to Creole differences between the actual prices realized and the market prices prevailing at the time of the transactions.

Standard Oil was given 20 days to answer the denial of the motion.

## Deferments Await Action of Mobilization Committee

WASHINGTON. — Additional deferments for workers in the oil industry await consultation with the committee on occupational deferments named by James F. Byrnes, director of Office of War Mobilization, according to a statement of George E. Dewey, manpower counselor of Petroleum Administration for War. Information concerning the status of petroleum employes in the under-30 group had been obtained from about 75 per cent of the concerns affected, Dewey said, and PAW was prepared to present a "strong case" to the committee.

PAW so far has made only a written request for additional deferments and has not yet had an opportunity to present its case. Approximately 9,000 employes will be lost if the industry is allowed to defer only 30 per cent of its men between the ages of 18 and 29, PAW estimated.

Half a dozen other industries have been granted exemption from operation of the requirement for drafting 70 per cent of the under-30 employes.

# Gill Expects Capital Outlay by Industry to Reach 23 Billion Annually

PHILADELPHIA. — Probable expenditures by the oil industry for capital goods in the postwar era should approximate 23 billion dollars annually, according to John D. Gill, a director of Atlantic Refining Co., in an address last week before the Bond Club here on the general financial position of the petroleum business.

His figures indicate prospective annual capital expenditures by the industry of about $1,945,000,000, including the reinvestment of capital reserves.

Gill also believes continued large and growing demand for the industry's products is reasonably assured. Most established uses for petroleum are expanding. New uses are being developed. In addition to the intriguing prospects for aviation, widened use of gasoline-powered tractors on the farm and elsewhere, and a prospective vast development of industrial machinery of the bulldozer type for construction and other purposes, there is the emerging chemical branch of the petroleum industry.

The financial position of the oil industry in the United States, as represented by a composite of the records of companies doing upwards of 75 per cent of the business of the entire industry, compares favorably with the records of other large industries, Gill said.

The industry, he declared, should be counted on to do its share in utilizing capital. For example, historical trends, modified by considerations of the forces now at work, such as increasing efficiency in the use of capital, when projected over the next decade, indicate for 1955 a total gross investment of the order of 29 billion dollars, or 7½ billion higher than at present. Much of the new funds should be used in the industry's foreign development. Some of the increment probably will be supplied, as heretofore, from earnings, but a substantial part, perhaps as much as 4½ billion, should be derived from the general capital pool.

## National Cooperative Buys Pryor & Lockhart, Inc.

WICHITA, Kans.—Pryor & Lockhart, Inc., independent oil-producing concern, with headquarters here, has been purchased by National Cooperative Refinery Association, marking the first outright acquisition of a producing company by the association, though it holds interests in 10 producing wells.

This latest transaction gives the cooperatives a working interest in 46 additional producing wells and includes transfer of lease interests in more than 18,000 acres of drilling sites in Kansas. Present offices of Pryor & Lockhart in Wichita will be continued.

## Eight Companies Urged to Seek L.P.C. Ceiling Price

WASHINGTON. — The Office of Price Administration has telegraphed eight oil companies asking them to apply to it for ceiling prices on the sale of liquefied petroleum gas for the manufacture of carbon black.

None of these companies sold liquefied petroleum gas for carbon black during the price-base period but the War Production Board has now requested such sales. The companies were advised by OPA that there is no established maximum price for such sales but if they will apply by telephone or telegraph under the provisions of section 8.3 of Maximum Price Regulation 88 they will receive prompt action in establishing a ceiling price.

The companies concerned are Phillips Petroleum Co., Warren Petroleum Co., Hanlon-Buchanan, Inc., Carter Oil Co., Skelly Oil Co., Sinclair Refining Co., Cities Service Oil Co., and Lone Star Gas Co.

*Newly elected executive committee of the American Association of Petroleum Geologists: M. G. Cheney, Anzac Oil Corp., Coleman, Tex., president; M. Gordon Gulley, Gulf Oil Corp., Pittsburgh, vice president; Edward A. Koester, Darby & Bothwell, Inc., Wichita, secretary-treasurer; Gayle Scott, Texas Christian University, Fort Worth, editor; Ira H. Cram, Pure Oil Co., Chicago, retiring president and new chairman of the committee*

# DEATHS

**J. J. Theisen,** 63, a director of Mid-Continent Petroleum Corp. and president of Theisen-Clemens Oil Co., a marketing concern, died March 29 in St. Joseph, Mich. He had been in the oil-distributing business 40 years.

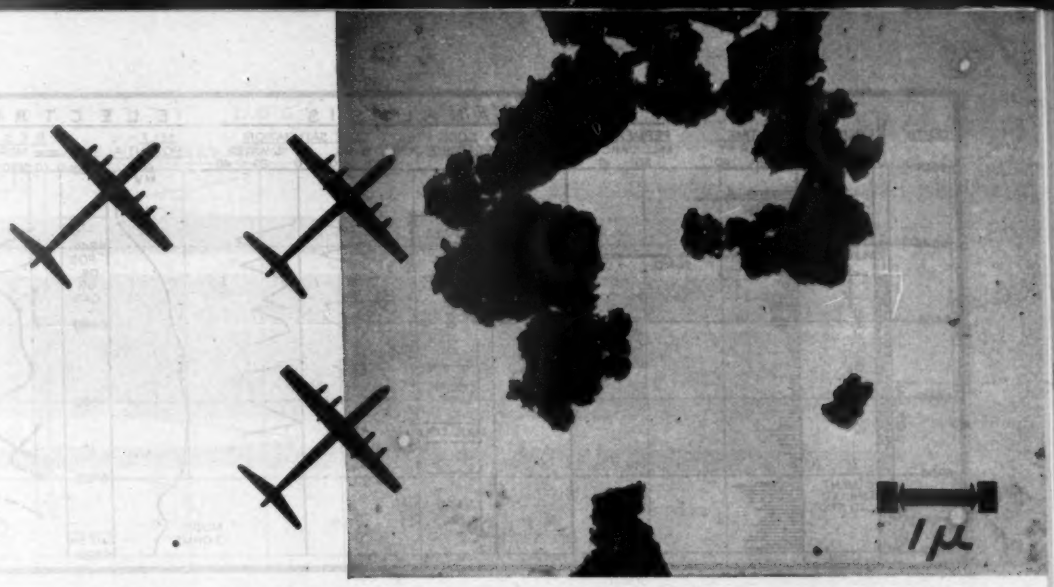
**G. Fred Jones,** 58, retired independent oil operator, died March 28 in Tulsa.

**John C. Vann,** 49, secretary-treasurer for Christian-Carpenter Drilling Co. and office manager for J. R. Turnbull, drilling contractor, died March 30 in Houston. He was one of the organizers of Christian-Carpenter. As a first lieutenant in World War I he was wounded three times and gassed, and was awarded the Distinguished Service Cross and the Silver Star.

**Albert Digel,** 66, Coleville, Pa., in the oil and gas business since 1897 and formerly superintendent for S. H. Elder & Co., which concern he founded, died March 29 in Buffalo, N. Y., where he was visiting relatives.

**Ward A. Miller,** 76, an early associate of the Rockefellers in the old Standard Oil Co., died March 29, in Cleveland, Ohio. He was president of Illinois Pipe Line Co. at the time of his retirement 15 years ago. Miller went into the oil business while still a boy with his father, the late Anson C. Miller, who built and managed some of Standard Oil's first pipe lines.

**Don B. Howard,** 50, auditor in the disbursement department of Skelly Oil Co., was found dead in Tulsa April 2 under circumstances which caused an official investigation to determine whether he was a homicide victim. Howard was a veteran of World War I.




## *B-29S WING TOWARD TOKYO*

This might be flak or a Jap-held atoll. Actually, it is a micrograph made with our electron microscope showing the *UOP Synthetic Fluid Cracking Catalyst* magnified 12,500x. The small scale at the side indicates 1 micron or about 39 millionths of an inch. Laboratory studies such as these improve aviation gasolines so that B-29s *can* wing to Tokyo.

| | | |
|---|---|---|
| *CATALYTIC CRACKING* | *THERMAL CRACKING* | *RETREATING* |
| *CATALYTIC REFORMING* | *THERMAL REFORMING* | *POLYTREATING* |
| *HYDROGENATION* | *HYDROFORMING* | *U. O. P. CATALYSTS* |
| *ALKYLATION* | *DEHYDROGENATION* | *UNISOL TREATING* |
| *ISOMERIZATION* | *POLYMERIZATION* | *U. O. P. INHIBITORS* |

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For All Refiners

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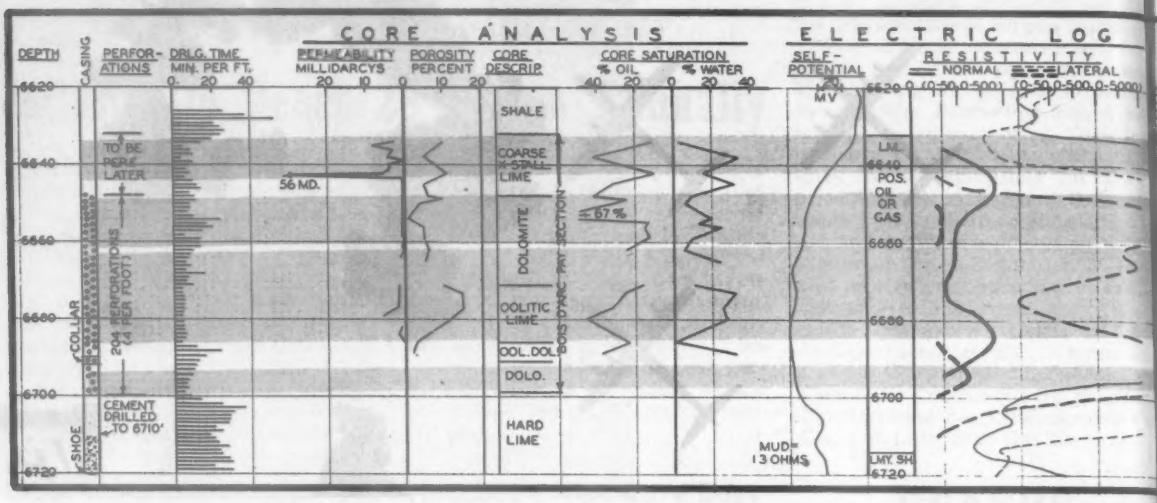



*Side-by-side comparison of pay formation data obtained in one well by (1) drilling and coring time, [illegible]*

# Six Different Engineering Methods Compared in Study of Pay Formations

**by Kenneth B. Barnes**

RESULTS of surveys or tests of the productive formation in a new well always are of interest because such data, more than any other factor, often tell the most about forthcoming performance and ultimate recovery. In short, formation surveys and tests make up a good part of the primary means of well evaluation.

This article describes results obtained in one well where nearly every kind of survey or pay-formation test method now available was used, other than those of strictly geological character.

The data gathered were: (1) drilling and coring time, (2) complete core analysis, (3) electric log, (4) gamma ray log, (5) neutron log, and (6) electric pilot survey. General scope and limitations of these different survey and test methods are fairly well established. However, it also is well recognized that actual field trials and experience are necessary to find, for each, the adaptability and proper interpretations as to specific formations and given pools. To determine these, to serve as guidance in beginning a drilling campaign in the West Edmond field, was the purpose of the case presented here.

The formation tested was the Bois d'Arc pay section of the Hunton limestone, which in the well consisted of zones of coarsely crystalline limestone, dolomite, and oolitic lime. These types of productive formations are among the most difficult kinds to evaluate precisely.

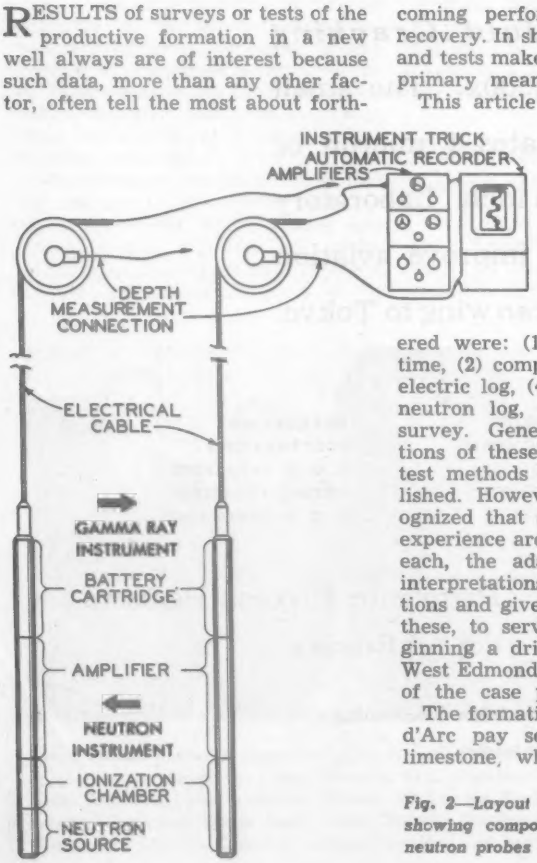


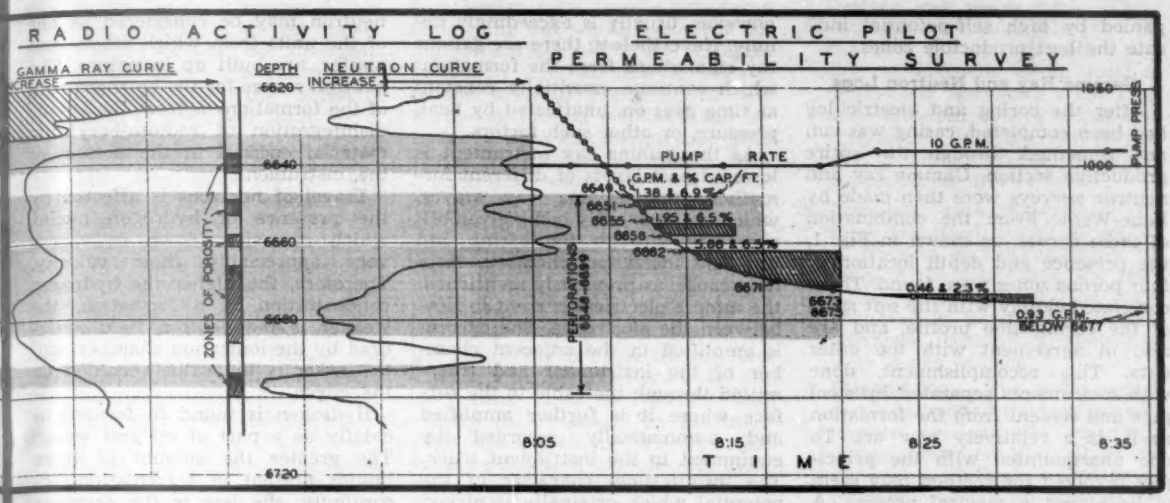

*Fig. 2—Layout of radioactivity apparatus, showing components of gamma ray and neutron probes*

### Drilling and Coring Time

Drilling time on the well, including coring of the Hunton, was obtained automatically by a geolograph recorder. The data are plotted in Fig. 1 as minutes per foot. Operation and utility of this equipment have been described recently by Reed[1].

The well was cored from 6,629 to 6,721 ft. (92 ft.) which interval extends through all of the productive zones. A retractable wire-line core barrel was used with the coring intervals (continuous) being of 3-ft. lengths. Recovery from the pay section was 37 per cent, which is only slightly lower than the average of about 41 per cent obtained in the locality with conventional-type barrels. Total time to take all of the short 3-ft. cores by the wire-line procedure was not more, however, than that which would have been required to take the same amount of 20-ft. cores by conventional means. The recovery from the short cores, of course, could be spotted within a much shorter interval of depth position.

On the coring-time log, four major zones of rapid penetration or "soft spots" show up. The location of




*...complete core analysis, (3) electric log, (4) gamma ray log, (5) neutron log, and (6) electric-pilot survey*

these may be compared in Fig. 1 through to the data covering the other tests.

### Core Analysis

In profile form, in Fig. 1, are shown the permeability, porosity, oil and water saturation values which were found for the cores. The complete picture of all of the productive formation is not presented by these results because of the core losses and it seems rather certain from some of the other surveys that only the tighter and harder portions of the pay are represented.

The core anaylsis showed the presence of the highest zone, of some 11 ft., to lie within 6,632-6,648 ft. This section consisted of coarsely crystalline limestone with average porosity of 8 per cent and average permeability of approximately 9 millidarcys. This was the only zone in all of the core recovery that showed appreciable permeability.

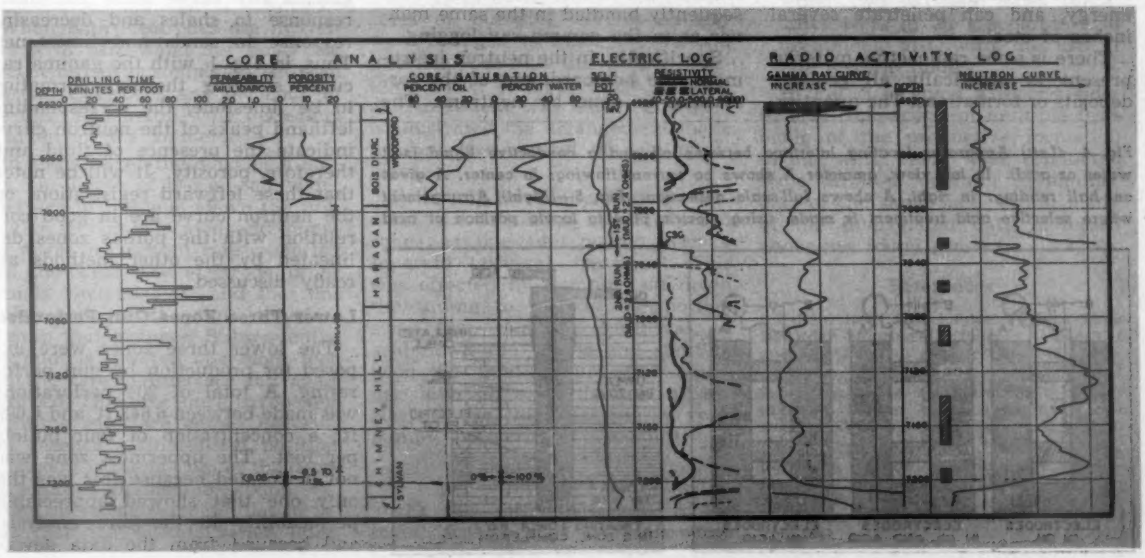
### Electric Log

In Fig. 1 are shown the self-potential and normal and lateral resistivity curves for the Schlumberger log which was run.

These data are used, in formation evaluation, to obtain correct formation thickness and depth, and for qualitative evaluation of fluid and ability of the formation to produce the fluid. It has been observed that, in any particular area of the field, there is correlation between high self-potential and high production. Due to recognized electrical and chemcal phenomena, the self-potential curve in the Hunton does not exhibit large variations opposite some of the thin, highly permeable and porous streaks. Studies indicate, however, that special significance can be attached to small "kicks" of a few millivolts as these correlate with and delineate the porous zones.

In interpreting electrical logs in the Hunton it is necessary to study all three curves simultaneously, comparing the relation of resistivity variations to self-potential variations at similar depths. It has been found that the most permeable and porous zones are exhibited, in general, on the electrical log by a correspondence of high self-potential and relatively low or decreasing resistivity values. This relation is explained by the fact that hard, nonporous lime has almost infinite resistance whereas porosity with connate water has a relatively lower resistivity value. Here, accordingly, the relatively lower resistivity variations accom-

*Fig. 3—A second side-by-side comparison of multiple tests made of the productive formation in one well; by different operator in another part of the same field*



panied by high self-potential indicate the best producible zones.

### Gamma Ray and Neutron Logs

After the coring and electric log had been completed, casing was run and cemented through the entire productive section. Gamma ray and neutron surveys were then made by Lane-Wells. From the combination of these curves, as shown in Fig. 1, the presence and depth location of four porous zones were found. These correlated closely with the soft spots of the coring-time profile, and are also in agreement with the other data. This accomplishment, done with instruments separated by steel pipe and cement from the formation itself, is a relatively new art. To one unacquainted with the principles involved the method may seem to be almost a magical process. A schematic layout of the radioactivty logging apparatus is given in Fig. 2.

### Gamma Ray Logging

The gamma ray instrument or probe which is lowered into the well contains two finely drawn electrodes in an ionization chamber which is filled with an inert gas under high pressure. Under normal conditions the insulating properties of the gas keep any current from flowing when an electrical potential is applied to the electrodes. When the chamber and the electrodes are subjected to gamma ray radiation from a formation, however, the gas is partly ionized and a small electrical current flows between the electrodes.

Radioactivity is the spontaneous change of the atoms of one element into those of another. During the disintegration of radioactive elements, alpha, beta, and gamma rays are given off. The gamma rays are electro-magnetic waves of very short lengths. They travel with the velocity of light, have properties which serve to identify them with radiant energy, and can penetrate several inches of steel.

There is some radioactive material present in practically all geologic deposits or formations. The quantity, however, usually is exceedingly minute. Nevertheless, there are gamma ray emanations from the formations which continue essentially constant as time goes on, unaffected by heat, pressure, or other such factors.

As the gamma ray instrument is lowered past layers of different formations the gamma ray waves, which are constantly being given off, penetrate through the casing and into the ionization chamber. Here they cause, as previously mentioned, the minute electrical current to flow between the electrodes. The current is amplified in the adjacent chamber of the instrument and transmitted through the cable to the surface where it is further amplified and automatically recorded by equipment in the instrument truck. The infinitesimal character of the potential which originally is picked up by the instrument in the ionization chamber can be judged by the fact that it is on the order of one ten-trillionth of an ampere. Absolute values are ordinarily not measured, as relative changes in the radioactivity characteristics of different formations are sufficient for determining changes of formation.

In general, shales are the most radioactive while sands and limestones are the least. The equipment is designed to record increasing radioactivity in the righthand direction on the scale.

### The Neutron Curve

The neutron instrument is essentially the same as the gamma ray equipment except that it is designed to first bombard the formation with electrical particles. The particles in turn are reflected back, to a greater or lesser degree, to the ionization chamber where they produce a small electrical current between the electrodes in the ionization chamber. The currents are amplified, transmitted to the surface, and subsequently handled in the same manner as in the gamma ray logging.

Specifically, in the neutron instrument, the bombardment of the formations is done by neutrons. The neutron may be considered as one of the units from which atoms, and matter, are built up in nature. The neutron source for the bombardment of the formations is from the atomic disintegration of radium-beryllium material encased in the bottom of the instrument.

Travel of neutrons is affected by the presence of hydrogen nuclei, which can slow down or absorb very appreciably their velocity. Therefore, the higher the hydrogen concentration in a formation, the weaker is the neutron field measured by the ionization chamber, and the lower is the value recorded on the curve.

Hydrogen is found in formations chiefly as a part of oil and water. The greater the amount of these liquids present in a formation, accordingly, the less is the response of the neutron instrument. On the curve a weak response is recorded, that is, one on the low or left side. Again, relative changes are measured and not absolute values, although the latter is possible.

Shales, while practically impermeable, are very porous, and contain considerable hydrogen as part of their interstitial, absorbed and chemically combined water. As a result, the response of shales is the lowest on the neutron curve. Dense formations containing but little fluid record as highs (to the right).

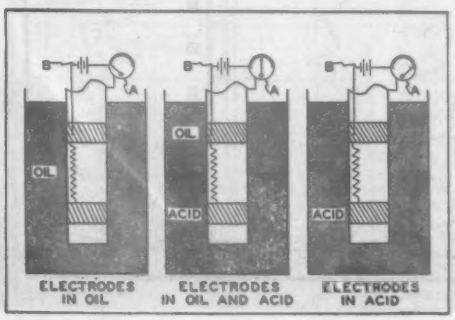
### Use of Gamma Ray and Neutron Curves

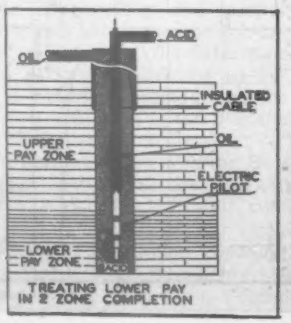
In interpreting radioactivity surveys, it is highly desirable to have both the gamma ray and neutron curves, which together are called a combination radioactivity log. For example, a leftward movement (decreasing radioactivity) of the neutron curve indicates either fluid (hydrogen) and therefore porosity, or shale. On the other hand, the gamma ray curve gives increasing response to shales and decreasing response to sands and limestones. Thus, in Fig. 1, with the gamma ray curve showing the pay formation to be limestone, the corresponding lefthand peaks of the neutron curve indicate the presence of fluid and, therefore, porosity. It will be noted that these leftward registrations on the neutron curve are in good correlation with the porous zones delineated by the other methods already discussed.

### Lower Three Zones Gun Perforated

The lower three zones were exposed for production by gun perforating. A total of 204 perforations was made between 6,648 ft. and 6,699 ft., a concentration of four bullets per foot. The uppermost zone was not perforated because this was the only one that showed appreciable permeability in the core analysis, and because, from the data devel-

*Fig. 4—(Left) Apparatus locating interface between oil and a conductive liquid (salt water or acid). In left view, ammeter A shows no current flowing; in center, A gives one-half reading; in right, A shows full-scale deflection. Fig. 5—(Right) Arrangement where selective acid treatment is made, using electric pilot to locate position of acid*



oped to this point, it appeared that selective acidization of the lower three zones would be desirable. Leaving the upper zone temporarily isolated facilitated the selective acidization of the other three.

### Electric Pilot Permeability Survey

A few days following the gun perforating, a Dowell electric-pilot survey was made to determine the actual or effective permeable capacity of the different exposed pay intervals as they existed after the well had been placed on production. Detailed descriptions of this method have been given by Hefley and Fitzgerald[2] and Lehnhard and Cecil[3]. The equipment involved in electric-pilot surveying are illustrated in Fig. 4.

In brief, the heart of the apparatus consists of an electrical fluid-interface locator which is lowered into the well. The hole is filled with salt water to a point above the exposed producing section, and then to the surface with oil. At the surface, oil is pumped in at a constant rate. Consequently, the crude oil-salt water interface is gradually lowered past the perforations or face of the producing formation. The rate of lowering of the interface is followed by the electrical locator.

An electrical circuit between the electrodes is completed when they are in contact with the conductive fluid in the well (this can be either salt water or hydrochloric acid), but is not completed when both electrodes are immersed only in the oil. The upper and lower electrodes are connected by an insulated wire which has high electrical resistance.

When one electrode is in oil the other is in salt water (or acid), thus straddling the oil-salt water interface, the electric circuit is completed between the lower electrode and the body of the unit. With the resistance in the circuit a half-scale deflection of ammeter is obtained.

When both electrodes are in contact with salt water (or acid) the electric circuit is completed between the two electrodes and the body of the unit, and a full-scale deflection is given on the ammeter.

In practice, at the start of a survey, the depth of the oil-salt water interface in the hole above the productive section is located, and pumping of oil at constant rate is started into the well. The electrode probe then is lowered 1 ft., and the time determined for the fluid interface to drop that distance. Subsequently, the pilot is lowered one more foot, and the rate of interface fall again recorded. This procedure is repeated until the interface ceases lowering and reaches a final fixed position. This point is the bottom of the deepest exposed permeable section.

The operating principle lies in the fact that the oil-salt water interface lowers most rapidly when the underlying salt water column is being forced into all of the different permeable intervals that are present in the well. As the injection rate at the surface is constant, the interface lowers at constant rate until it reaches the first permeable zone. It then drops more and more slowly as it passes consecutive permeable sections and the remaining salt water flow below the interface is confined to the fewer and fewer remaining permeable sections. Thus, at the beginning, the salt-water injection is into 100 per cent of the permeable capacity. As the interface lowers, the injection proceeds into decreasing units of capacity until finally all are passed by the interface, which then comes to rest. The minutes required to lower the interface a given distance are plotted against the corresponding depth scale.

In the well at hand, the time-depth plot in Fig. 1 shows that the second zone of the four had two permeable intervals, one of 13.8 per cent of the total capacity and the other of 19.5 per cent. The next zone contained 58.8 per cent of total capacity, and the lowest had two sections, of but 4.6 and 3.3 per cent total capacity.

### Selective Acidization of Exposed Zones

With the bottom zone having the least effective permeable capacity, it was first acidized by itself. The selective treatment was done by filling the hole to the surface with crude oil, then spotting acid from the bottom up to 6,674 ft. Top of the acid was held at 6,674 ft. by use of the same interface locating apparatus used in the permeability survey. Acid was pumped down the tubing and oil down the annulus. As the oil-acid interface tended to move up or down from 6,674 ft., the rates of pumping correspondingly were changed to move the oil-acid interface back to the proper position. Using this procedure a 1,000-gal. treatment was made. In Fig. 5 is illustrated the arrangement made for selective control of acid treatment.

Following the first selective treatment, the remaining upper exposed zones as one unit were given a separate 1,000-gal. treatment. This was effected by pumping oil down the tubing to blanket the bottom zone, then pumping 1,000 gal. of acid down the tubing and spotting it in the annulus opposite the upper interval, with the aid of the electric pilot, then applying the two-pump "pressuring" procedure.

### Summary

The six different tests, in the main, accomplished the following:

1. **Drilling and coring time.**—These obtained, inexpensively and at the time the pay formation was first opened, the depth location of the four "soft spots". The rate-of-penetration data were used in conjunction with the core anlysis, and in making deductions as to the character of core losses.
2. **Complete core analysis.** — This work furnished numerical values of porosity and permeability for parts of the pay zones; the saturation data showed the pays tested all to be of oil-productive character (conversely, that none were water bearing).
3. **Electric log.** — The self-potential curve delineated the over-all permeable section; the resistivity curves indicated that all of the permeable intervals would be oil productive (with no portions being "water pays"), and the normal resistivity curve also gave indications reflecting changes in permeability.

4-5. **Combination radioactivity survey.**—Made up of the gamma ray and neutron curves, this showed the location and thickness of all four zones of porosity. These data were obtained after the pipe had been set through the zones and cemented.

6. **Electric-pilot survey and selective acidization.**—Done after the three lower zones had been exposed for production by gun perforating, the electric pilot permeability survey, in particular, showed that for some reason, possibly drilling-fluid contamination or mud sheathing, the bottom zone had much the less effective permeable capacity. Consequently, a selective acid treatment was made of the bottom zone alone to increase the capacity, this time by using the interface locator for control purposes. The other two exposed zones thereafter were given a separate acid treatment, also with the use of the electric pilot.

In Fig. 3 is given a second side-by-side comparison of multiple tests made of the productive formation in one well. These were conducted by a different operator in another part of the same field. Again many of the interrelated data discussed above are found present.

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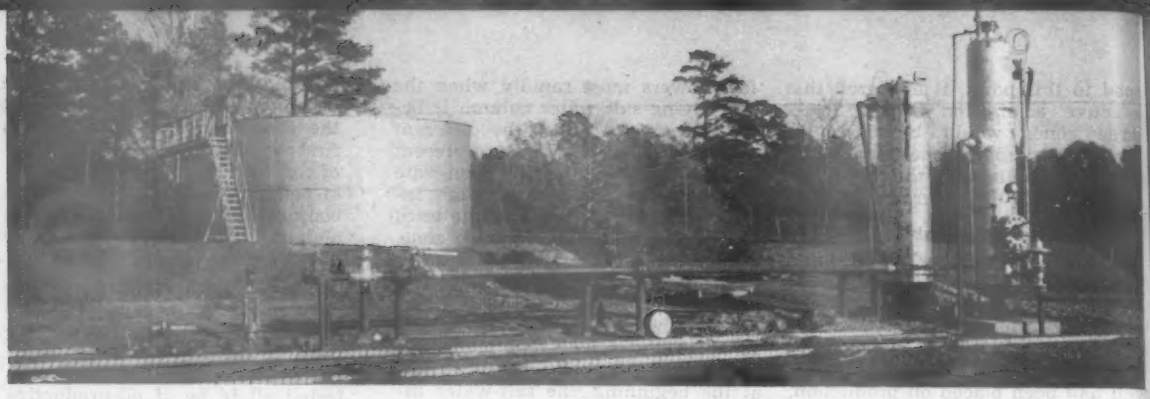


*Two-stage separator installation for low-ratio well in Lake St. John field. Pressure-reducing valve for high-pressure gas to field-gas system is visible at left end (on ground) of orifice-meter run*

# Lake St. John Field Served by Central High-Pressure Gas System

**by Neil Williams**

THE Lake St. John field in Concordia and Tensas parishes, eastern Louisiana, is being served by a central high-pressure gas system. Designed to supply fuel for drilling rigs and other operational requirements, the system functions to provide utilization of all gas production in the field. Its operation is controlled to meet field fuel needs so far as possible from vent gas recovered in production of low-ratio oil wells. High-ratio and gas wells are tied into the system to insure an adequate volume of gas and uniformly maintained pressures, but withdrawals from such wells are restricted automatically for conservation of reservoir resources and energy.

A similar system also has been provided at Cranfield, Adams County, Mississippi, about 30 miles southeast of Lake St. John. In both fields, California Co. is the principal operator (at Cranfield, this company has been the sole operator to date). Cranfield, although exceeding Lake St. John in productivity, so far is slightly smaller in areal extent, but reservoir and structural characteristics and production program are comparable, and as for operation of their respective gas systems, a description of the one at Lake St. John is representative of both.

The producing horizon currently being developed is the Massive sand (basal Tuscaloosa), found at depths of from 9,000 to 9,200 ft. (10,300-10,400 ft. at Cranfield). The reservoir is featured by an extensive gas cap covering an area approximately 5 miles long and from 2½ to 3 miles wide over the top of the structure, believed to be a deeply seated salt dome. The protection of this gas cap and conservation of its rich condensate reserve for later recovery in a proposed cycling project is a primary objective in the production program.

Development is being confined so far as possible to downstructure locations circling the rim of the gas cap area where 40° gravity oil production having relatively low gas-oil ratios is being proved up. In less than a year's time production already has been established around the northwest and north, the west, and the south and southeast sides with prospects that the present separate areas will be linked in a continuous line of production around all sides. At one place on the northwest side, where most of the development has occurred, this rim already has been proved over 1½ miles wide although no attempt is being made at this time to step out in exploration of the outer limits. To the contrary, with a view toward avoiding as much risk as possible and to make all wells count, the program calls for keeping locations safely within the contours of the actual oil column so far as can be determined in advance of drilling.

Wells completed so far include 14 low-ratio oil and 4 high-ratio distillate and gas wells. All except one low-ratio well drilled by Carter Oil Co. on the extreme west flank, are owned by California Co. One gas well was completed during the course of development of Wilcox sands, found productive at depths of from 3,400 to 4,500 ft. in a relatively small area on top the structure overlying the Tuscaloosa gas cap. In this development which took place prior to the discovery of oil production in the Tuscaloosa, a number

*Heater installation on flow line from high-pressure gas well to separator. The heater is located ahead of pressure-reducing valve at high-pressure separator (background). The elevated tank supplied makeup water to the heater*

of wells were carried on down in exploration of the latter horizon. Finding only gas and distillate in this horizon, all these wells, except the one gas well, were plugged back and completed in one of the several Wilcox sands. The gas well, which was unproductive in the Wilcox, was completed in the lower horizon to supply fuel for other development. The other three high-ratio distillate wells are high structural wells drilled since then on the edge of the gas-cap area in connection with the development of the present Tuscaloosa oil production.

Gas and high-ratio distillate wells are tied in but float on the high-pressure gas system, supplying only enough make-up gas to balance any deficiency in volume not available from the low-ratio wells. So far, gas recovery from low-ratio wells is not adequate at all times to meet field fuel demands, and some production is required from the high-ratio wells. As more low-ratio wells are completed, and their aggregate gas production increases, withdrawals from the high ratio and gas wells will be reduced accordingly.

Nine drilling rigs now are operating at scattered locations around the structure and are taking fuel from the common gas system.

Normal ratios of the oil wells run approximately 1,000 cu. ft. of gas per barrel. Present allowable oil production, based on various factors, is approximately 260 bbl. daily, which yields a total gas production of about 260,000 cu. ft. daily per well. Flowing pressures, except for the three low-pressure wells, are slightly over 1,800 lb. Three of the four distillate and gas wells have ratios of approximately 12,000 cu. ft. per barrel with flowing pressures from 2,700 to 2,800 lb. In the fourth well, the ratio is considerably higher, making nearly a 100 per cent gas well. It has a well-head pressure of around 3,300 lb.

The gas-gathering and fuel system consists of a 3-in. high-pressure main line extending the length of the field with 2-in. laterals from the various lease-separator installations. At present approximately 800 lb. pressure is being maintained in the system, although this may be varied according to needs by changing the settings of pressure regulators on the feeder line. Automatic pressure control insures uniformly maintained pressure throughout the system to compensate for excessive withdrawals that might occur at some point on the system.

The high-pressure system has occasioned the employment of two-stage separation in production of wells. Each battery installation includes both high-pressure and low-pressure separators. Gas for the system is taken directly from the high-pressure separator vent line in initial separation of well production. Fluid from this separator is dumped to the low-pressure separator for final separation. Gas vented from the low-pressure separators, operated under a back pressure of about 40 lb., is relatively small in volume.

Operations are centralized so far as possible, and for this reason all stock tanks and separators for the respective leases, except the high-pressure separator installations for each of the high-ratio and gas wells, are concentrated at central locations. High-pressure separators for the latter wells are located near the respective wells to avoid having any longer high-pressure lines than necessary.

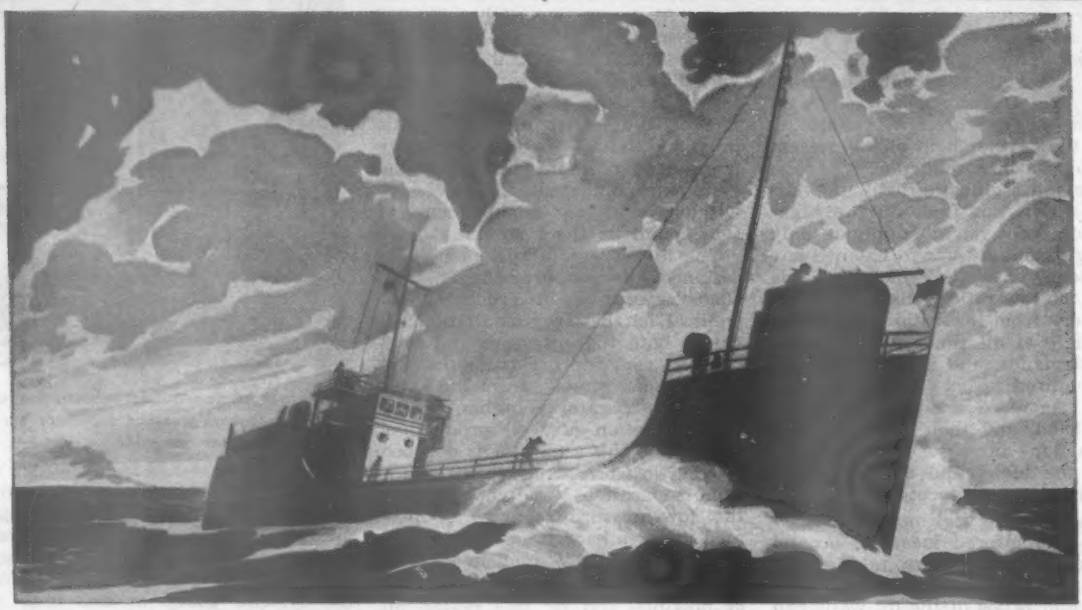
Pressure control on the system is maintained by means of pressure-reducing regulators on the outlet lines of the various high-pressure separators. The regulators function as back-pressure valves on the separators. Regulators for the separators serving low-ratio wells are set at the desired operating pressure for the system, which at this time is approximately 800 lb. The regulator for the gas well is set at slightly lower pressure, in this case about 750 lb., so that this well is not drawn on unless the gas volume from low-ratio wells is not sufficient to maintain pressure in the system above that point. In turn, regulators for the three high-ratio distillate wells are set at pressures slightly under that of the gas well. These wells help to equalize pressures in the system in the event a heavy withdrawal of fuel from the system at some point near one of them tends to create an abnormally low pressure locally.

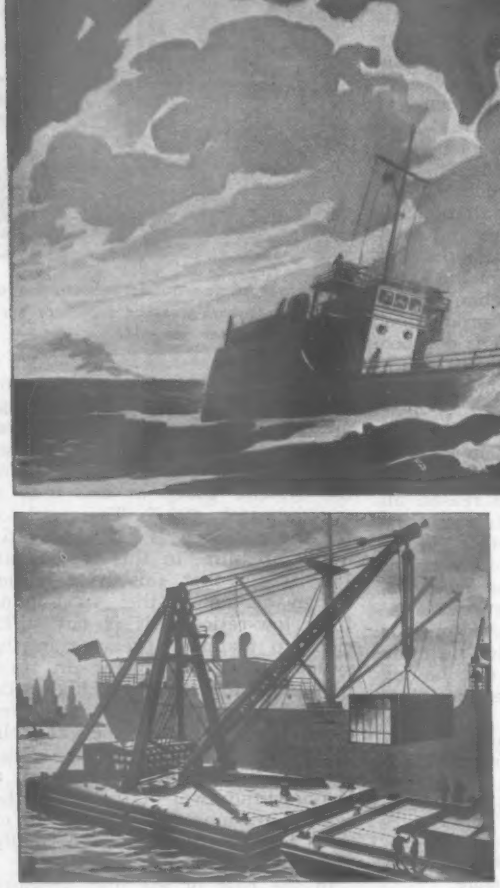
In the case of the high-pressure distillate and gas wells, a reduction in pressure is effected between the well and the high-pressure separator. This is accomplished by means of a pressure-reducing regulator valve installed on the line at that point. It is in addition to the back-pressure regulator placed on the separator outlet line to the gas system. This reduction in pressure necessitates the use of heaters to maintain the temperature of the gas above the point at which hydration occurs. Individual hot-water heaters of a standard, commercial type are installed in each case ahead of the pressure reducing regulator on the flow line. Each is direct fired with gas, a small volume of which is taken off the separator outlet line through a small pressure-reduction control. No heaters required in production of low-ratio wells.

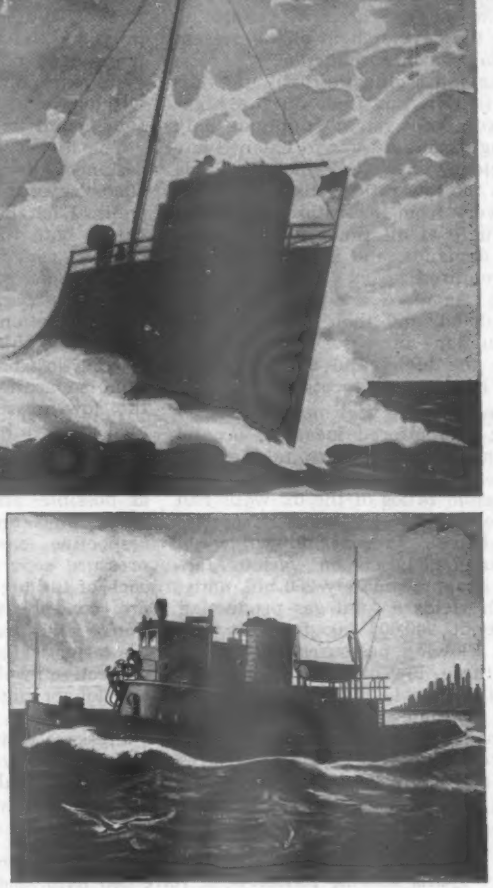
*Pressure-reducing-regulator installation on inlet line to high-pressure separator serving high-pressure gas well*

*Meter run on gas vent line from high-pressure separator to field-gas system showing pressure-relief valve (left foreground). Low-pressure separator for fluid discharge is located at central lease battery*

# Odenbach







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# Flow Equations for Gas Considering Deviations From Ideal Gas Laws

· by W. O. Clinedinst*

ONE of the earliest organizations to transport natural gas was The Fredonia Gas, Light, and Water Works Co. of Fredonia, N. Y. It is reported that for years its service was confined to communities near the gas fields, for the early wooden gas lines, turned and bored from random lengths of logs, were prone to leak and did not lend themselves to distant transmission. At that time an investigation of the effect of deviations from ideal gas laws on flow equations could have had little but academic interest.

The advent of the use of steel pipe opened the way to higher operating pressures and has made the present-day long-distance gas transportation line a reality. With pipe representing 40 to 70 per cent of the cost of gas lines, its efficient use is a dominant factor in over-all economy. Since the size, weight, and grade of pipe required to transport gas are determined by means of flow equations for estimating capacity, such equations should result in the most accurate estimate possible. Errors on the conservative side lead to expenditure of more money than necessary for pipe. On the other hand, to overestimate capacity will result in the line not performing the service intended.

The effect which deviations from ideal gas laws may have on flow equations has passed beyond the stage of academic interest, and if disregarded, may lead to reduction in efficiency and over-all economy.

## PART 1—DEVELOPMENT OF FLOW EQUATIONS

FLOW equations, such as Weymouth's, generally used for estimating capacities of gas lines, disregard deviations of natural gases from the ideal gas laws. For low pressures this is not likely to be of much importance. However, in considering the economics of higher pressures than presently used for gas lines, it would appear advisable to investigate the effect of such deviation on the flow equations.

Extensive studies of deviation of natural gases from the ideal gas laws have been made,[1,2] and it has been found that the deviations can be approximated by a compressibility factor Z introduced into the equation representing ideal gas laws as follows:

$$PV = Z N R' T \qquad (1)$$

where

P = pressure, in p.s.i. absolute
V = volume in cu. ft.
Z = compressibility factor
N = number of lb.—moles of gas

$$= \frac{\text{Weight of gas in pounds}}{\text{Molecular weight}}$$

R′ = Universal gas constant = 10.71 for cu. ft. p.s.i.
T = temperature, absolute = 460 + °F.

It is to be noted that Equation 1 reduces to the equation of ideal gas laws when the compressibility factor Z is replaced by unity. The compressibility factor Z has been found to be a function of the "reduced pressure" and "reduced temperature" of the gas. Curves of the compressibility factor have been determined from experimental data and have been published in treatises on this subject.[1,2] Fig. 1 shows curves of compressibility factor Z plotted against reduced pressure for various levels of reduced temperature. The relationship shown in Fig. 1 can be expressed mathematically as:

$$Z = \phi (P_r, T_r) \qquad (2)$$

where

$P_r$ = reduced pressure
$T_r$ = reduced temperature

TABLE 1—CRITICAL PRESSURE AND TEMPERATURES OF FUNDAMENTAL GASES

| Gas— | Formula | Critical pressure (lb./sq. in.) $P_c$ | Critical temperature (°F.) $T_c$ |
|---|---|---|---|
| Methane | $CH_4$ | 673 | 344 |
| Ethane | $C_2H_6$ | 712 | 549 |
| Propane | $C_3H_8$ | 617 | 666 |
| Isobutane | $C_4H_{10}$ | 544 | 732 |
| Isopentane | $C_5H_{12}$ | 483 | 829 |
| Carbon dioxide | $CO_2$ | 1,073 | 548 |
| Nitrogen | $N_2$ | 492 | 227 |
| Oxygen | $O_2$ | 730 | 278 |

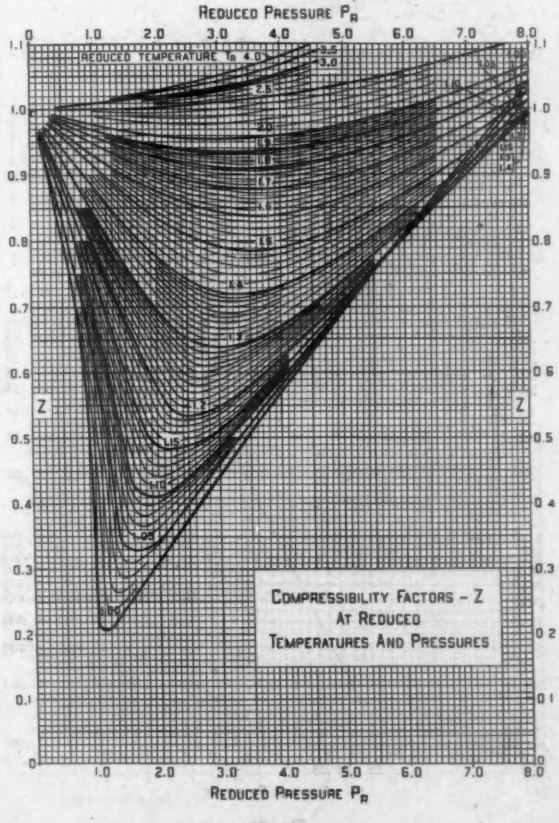



Fig. 1

*National Tube Co., Pittsburgh.

Reduced pressure $P_r$ and reduced temperature $T_r$ are ratios of the absolute pressure and temperature to the critical pressure and temperature of the gas components respectively. The relationship is expressed as follows:

$$P_r = P/P_c \quad (3)$$

$$T_r = T/T_c \quad (4)$$

where

$P$ = pressure in p.s.i. absolute
$T$ = temperature—absolute = 460 + °F.
$P_c$ = critical pressure of gas or gas mixture
$T_c$ = critical temperature of gas or gas mixture

Values of critical pressures and temperatures may be obtained from critical tables and handbooks.[1,2] A summary of some of the generally needed ones is shown in Table 1. These critical values are shown for pure gases such as methane, ethane, etc. For the usual natural gases consisting of mixtures of the fundamental gases, recourse is made to so-called "pseudocritical pressures and temperatures."[1,2] The pseudocritical pressure and temperature for a mixture of gases is related to the critical pressure and temperature of the fundamental gases in the following manner:

$$P_c = (P_c)_a N_a + (P_c)_b N_b + \quad (5)$$

$$T_c = (T_c)_a N_a + (T_c)_b N_b + \quad (6)$$

where

$N_a$ = gas (a) of gas mixture as a volume fraction
$N_b$ = gas (b) of gas mixture as a volume fraction
$P_c$ = pseudocritical pressure of gas mixture
$(P_c)_a$ = critical pressure of $N_a$
$(P_c)_b$ = critical pressure of $N_b$
$T_c$ = pseudocritical temperature of gas mixture
$(T_c)_a$ = critical temperature of $N_a$
$(T_c)_b$ = critical temperature of $N_b$

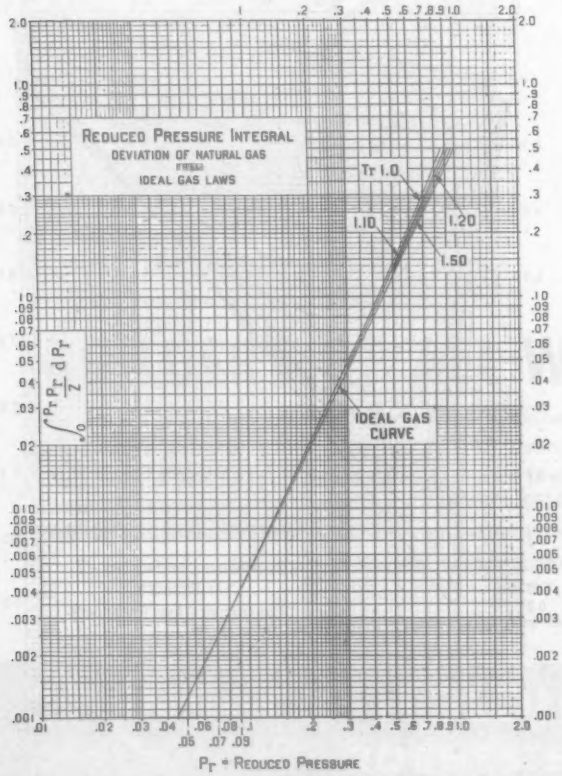



*Fig. 2a*

Let us examine the differential equation of the gas-flow pressure gradient:[3]

$$\frac{d(p + \gamma h)}{dx} = \frac{-f}{D} \frac{\gamma v^2}{2g} \quad (7)$$

where

$f$ = coefficient of friction of the gas in the line (see Fig. 3). (Sometimes the coefficient of friction is expressed with a value ¼ of f)
$D$ = inside diameter of pipe in ft.
$g$ = acceleration due to gravity = 32.17
$h$ = elevation variation in ft.
$p$ = gas pressure in lb./sq. ft. absolute
$v$ = velocity of gas in the line in ft./sec.
$x$ = length along the line in ft.
$\gamma$ = weight density of gas, lb./cu. ft.

The usual assumptions that are made when integrating Equation 7 to obtain gas-flow formulas are as follows:

1. Ideal gas laws apply.
2. Steady flow, i.e., the weight passing through every section of the line is the same.
3. Isothermal flow.
4. No variation in elevation.

The purpose of this paper is to determine the effect of changing assumption 1 to consider deviations of natural gases from the ideal gas laws. The revised assumption follows:

1. Gas laws expressed as Equation 1.
2. Steady flow, i.e., the weight passing through every section of the line is the same.
3. Isothermal flow.
4. No variation in elevation.

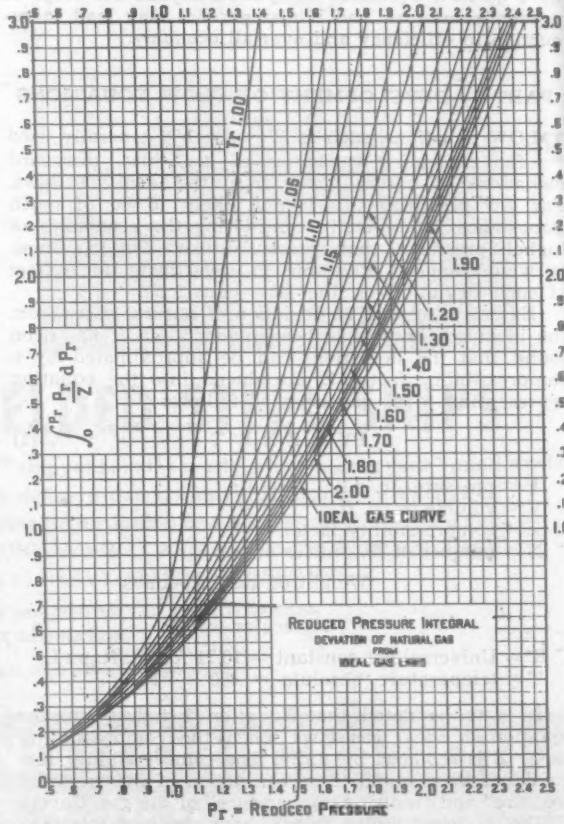



*Fig. 2b*

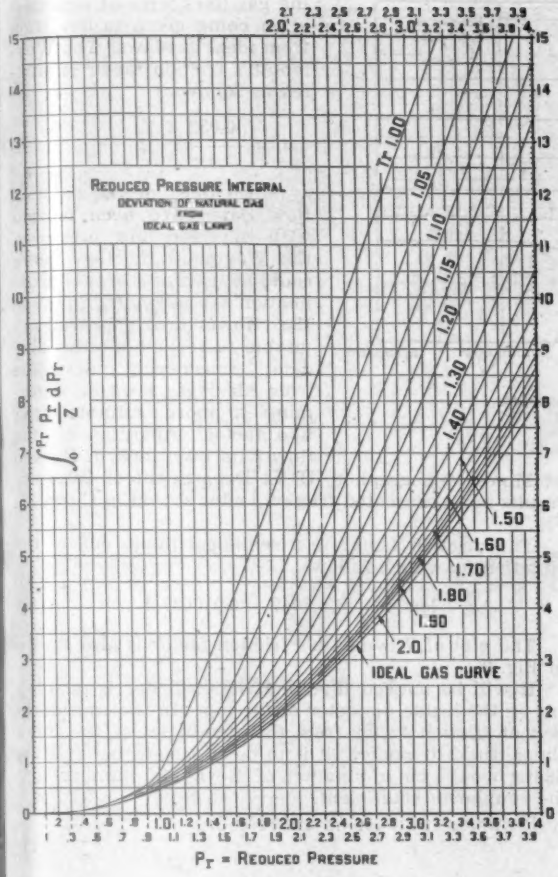



*Fig. 2c*

Revised assumption 1 is expressed by Equation 1 modified as follows:

$$\gamma = \frac{p\,M}{Z\,R'\,T} \qquad (1a)$$

where

M = molecular weight
R′ = universal gas constant (for all gases) = 1,543 for cu. ft., lb./sq. ft.

Assumption 2 of steady flow may be expressed:

$$C = \frac{\gamma\,\pi\,D^2}{4}\,v \qquad (8)$$

where

C = constant

Assumption 3 states that temperature T is constant throughout the line, i.e., it is not a function of x the length along the line.

Assumption 4, that elevation is constant, may be expressed:

$$\frac{dh}{dx} = O \qquad (9)$$

Substituting Equations 1a, 8 and 9 into Equation 7, we obtain:

$$\frac{dp}{dx} = \frac{-f\,C^2\,T\,R'\,Z}{2g\,(\pi/4)^2\,D^5\,Mp} \qquad (10)$$

Separating variables in Equation 10 and integrating, Equation 11 follows:

$$\int_{p_1}^{p_2} \frac{p}{z}\,dp = -\int_0^l \frac{f\,C^2\,T\,R'\,dx}{2g\,(\pi/4)^2\,D^5\,M} \qquad (11)$$

where

l = length of line in ft.
$p_1$ = entrance pressure in lb./sq. ft. absolute
$p_2$ = exit pressure in lb./sq. ft. absolute

Completing the integration indicated for Equation 11 we obtain:

$$\int_{p_2}^{p_1} \frac{p}{Z}\,dp = \frac{f\,C^2\,T\,l}{2(\pi/4)^2\,g\,D^5}\,\frac{R'}{M} \qquad (11a)$$

Equation 8 can be rewritten in terms of discharge rate in cu. ft. per second as follows:

$$C = \gamma_o\,Q_{sec} \qquad (8a)$$

where

$\gamma_o$ = weight density of gas at standard condition, lb./cu. ft.
$Q_{sec}$ = discharging rate in cu. ft. per second at standard condition

Substituting Equation 8a into Equation 11a and rearranging, the basic equation for discharge rate follows:

$$Q_{sec} = \frac{\pi}{4}\sqrt{\frac{2\,g\,D^5\int_{p_2}^{p_1}\frac{p}{z}\,dp}{f\,\gamma_o^2\,T\,l}}\,\frac{M}{R'}$$

replacing $\gamma_o^2$ by $\frac{p_o^2}{Z_o^2 T_o^2}\,\frac{M^2}{(R')^2}$ from (1a)

$$Q_{sec} = \frac{\pi}{4}\,\frac{Z_o\,T_o}{p_o}\sqrt{\frac{2\,g\,D^5\int_{p_2}^{p_1}\frac{p}{z}\,dp}{f\,T\,l}}\,\frac{R'}{M} \qquad (12)$$

but $R'/M = R_a/G$
$R_a$ = air constant = 53.33

Rewriting Equation 12 in terms of commonly used units, we obtain:

$$Q_{day} = 109.6622\,\frac{Z_o\,T_o}{P_o}\sqrt{\frac{d^5\int_{P_2}^{P_1}\frac{P}{z}\,dP}{f\,G\,T\,L}} \qquad (12a)$$

where

$Q_{day}$ = capacity in cu. ft. per day at standard condition
d = inside diameter of pipe in in.
G = specific gravity of the gas referred to air

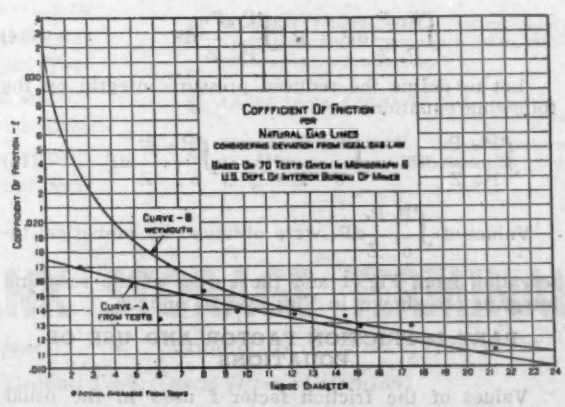
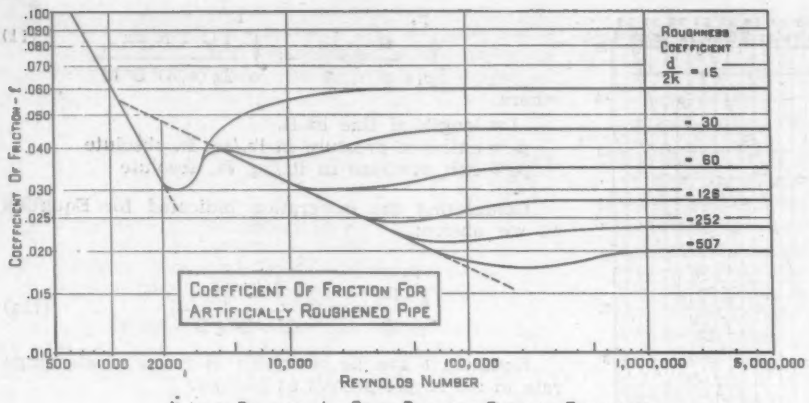



*Fig. 3*




d = Inside Diameter; k = Grain Diameter Creating Roughness

Fig. 4

$Z_o$ = compressibility factor at standard temperature and pressure
$P_1$ = entrance pressure in p.s.i. absolute
$P_2$ = exit pressure in p.s.i. absolute
$T_o$ = standard temperature, °F. absolute
$P_o$ = standard atmospheric pressure in p.s.i. absolute
L = length of line in miles
T = flowing temperature of the gas, °F. absolute
f = coefficient of friction (see Part 2) from Fig. 3

For gases following the ideal gas laws, Equation 11 reduces to the following well-known expression:

$$Q_{day} = 77.544 \frac{T_o}{P_o} \sqrt{\frac{(P_1^2 - P_2^2)\, d^5}{f G T L}} \qquad (13)$$

In the case of gases deviating from the ideal gas laws it becomes necessary to determine values of Z and to evaluate the pressure integral

$$\int_{P_2}^{P_1} \frac{P}{Z} dP.$$

It becomes convenient to express pressures and temperatures as reduced pressures and temperatures. To do this it is first necessary to determine the pseudocritical pressure and temperature of the gas mixture by means of Equations 5 and 6. Using the pseudocritical values so obtained, Equations 3 and 4 are employed to obtain the following:

$P_{r1}$ = pseudo reduced entrance pressure
$P_{r2}$ = pseudo reduced exit pressure
$T_r$ = pseudo reduced temperature

The pressure integral can be rewritten in terms of reduced pressure and critical pressure as follows:

$$\int_{P_2}^{P_1} \frac{P}{Z} dP = P_c^2 \int_{P_{r2}}^{P_{r1}} \frac{P_r}{Z} dP_r \qquad (14)$$

Let us define the reduced pressure integral by the following equation:

$$\int_{P_{r2}}^{P_{r1}} \frac{P_r}{Z} dP_r = \int_{o}^{P_{r1}} \frac{P_r}{Z} dP_r - \int_{o}^{P_{r2}} \frac{P_r}{Z} dP_r \qquad (15)$$

Values of $\int_{o}^{P_r} \frac{P_r}{Z} dP_r$ were obtained by numerical integration from Fig. 1 and the curves of the resulting integrals are shown in Figs. 2a, 2b and 2c.

## PART 2—FRICTION FACTOR AND USE OF EQUATIONS

Values of the friction factor f used in the usual Weymouth's formula were obtained by analysis of existing gas lines without consideration being given to deviation from ideal gas laws.[4] The Weymouth's friction factor is written as follows:

$$f = \frac{0.032}{d^{1/3}} \qquad (16)$$

Since most of the existing flow data have been on gas with relatively low pressures, the Weymouth friction factor could be used as a first approximation for use with Equation 12a. However, it appeared advisable to reexamine available data, considering deviation from ideal gas laws, to determine a more suitable friction factor. Analysis of the flow data published in Bureau of Mines Monograph 6, U. S. Department of Interior,[4] results in an estimated friction factor shown in Curve A, Fig. 3.

This friction factor is a semilogarithmic curve, the equation for which follows:

$$\log_{10} f = -1.7447 - 0.010637\, d \qquad (17)$$

The plot of Weymouth's friction factor is also shown in Fig. 3.

It will be noticed that the friction factor is dependent on the inside diameter of the pipe. In the consideration of friction factor from the standpoint of the more classic fluid dynamics,[3] it is to be expected that friction factor would be a function of Reynolds' number and the roughness coefficient.

Reynolds' number is expressed:

$$\text{Reynolds' number} = \frac{v D}{\mu} \qquad (18)$$

where

v = mean velocity in ft. per sec.
D = inside diameter in ft.
$\mu$ = kinematic viscosity in ft.²/sec.

The roughness coefficient is expressed:

$$\text{Roughness coefficient} = \frac{d}{2k}$$

where

k = roughness in in.

Fig. 4 shows a plot of friction factor against Reynolds' number for various levels of roughness obtained artificially by sand grains.[3] It is seen from the plot that for the high Reynolds' number generally encountered in gas lines, which range from 150,000 to 5,000,000, the friction factor is practically independent of Reynolds' number and dependent only on the roughness coefficient. Little is known about the roughness of pipe and the effect of the particular character on the friction factor. However, it is seen that if an average roughness were used for all pipe, the friction factor would become a function of diameter. Experimental investigation of effect of roughness of commercial pipe would likely reveal much of interest and value.

The friction factor function A of Fig. 3 appears to fit the test results well and should be suitable for use until further data permit a more refined estimate. In the numerical examples to follow this friction factor function will be used.

The use of flow, Equation 12a, considering deviations from the ideal gas laws, is best explained by numerical examples.

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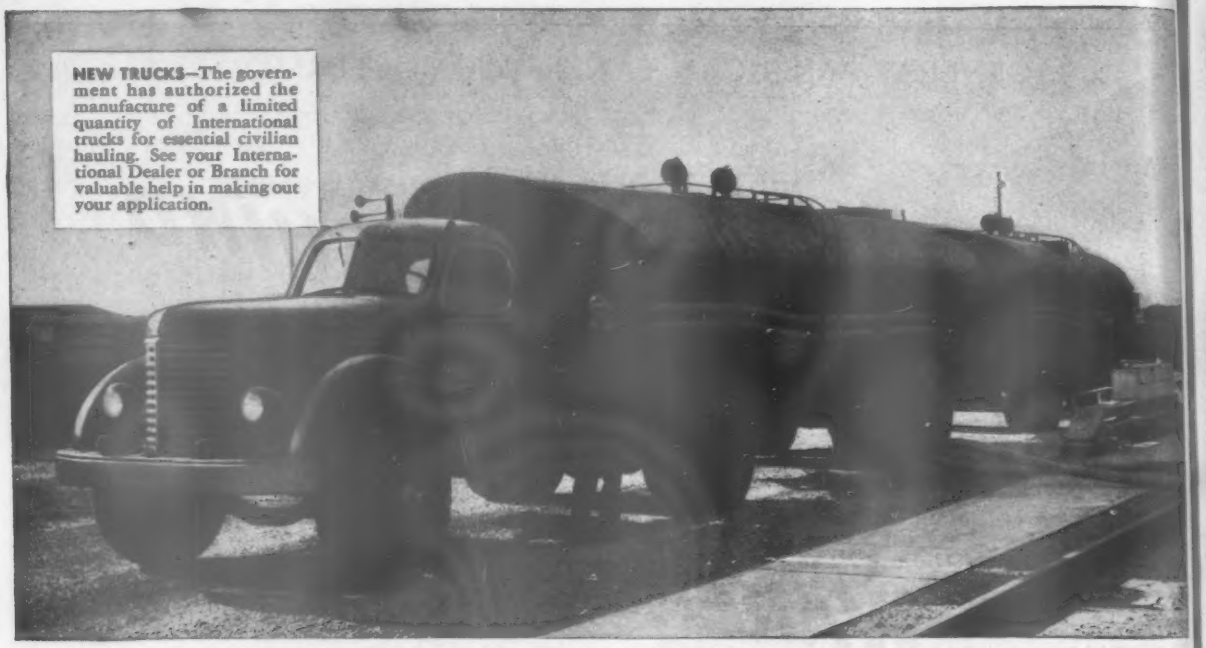

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**Example.**—Determine the daily capacity of a gas line consisting of 100 miles of 24-in. o.d. line pipe having an inside diameter of 23.438 in. The gas to be transported has a specific gravity of 0.632 and analysis is as follows:

| Gas— | Per cent by volume |
|---|---|
| Methane | 84.81 |
| Ethane | 14.26 |
| Nitrogen | .63 |
| Carbon dioxide | .15 |
| Oxygen | .15 |
| | 100.00 |

Standard pressure and temperature are 14.65 p.s.i. absolute, and 520° F. absolute respectively. The temperature of flowing gas is 520° F. absolute, the entrance pressure 775 p.s.i. absolute, and the exit pressure 395 p.s.i. absolute.

The pseudocritical pressure and temperature must be determined by means of Equations 5 and 6 and Table 1.

$$P_c = (P_c)_a N_a + (P_c)_b N_b + \quad (5)$$

$$P_c = 673\ (0.8481) + 712\ (0.1426) + 492\ (0.0063) + 1{,}073\ (0.0015) + 730\ (0.0015)$$
$$= 678.1 \text{ p.s.i. absolute}$$

$$T_c = (T_c)_a N_a + (T_c)_b N_b + \quad (6)$$

$$T_c = 344\ (0.8481) + 549\ (0.1426) + 227\ (0.0063) + 548\ (0.0015) + 278\ (0.0015)$$
$$= 372.6° \text{ F. absolute}$$

Reduced pressures and reduced temperatures are determined from Equations 3 and 4:

$$P_r = P/P_c \quad (3)$$

$$P_{r_0} = \frac{14.65}{678.1} = 0.0216$$

$$P_{r_1} = \frac{775}{678.1} = 1.143$$

$$P_{r_2} = \frac{395}{678.1} = 0.5825$$

$$T_r = T/T_c \quad (4)$$

$$T_{r_0} = T_r = \frac{520}{372.6} = 1.4$$

From Fig. 1 for $T_{r_0} = 1.4$ and $P_{r_0} = 0.0216$ we find that $Z_0$ is approximate unity. This will always be the case for atmospheric pressure.

The reduced pressure integral is calculated from Equation 15, using the above integration limits of 0.5825 and 1.143:

$$\int_{0.5825}^{1.143} \frac{P_r}{Z} dP_r = \int_0^{1.143} \frac{P_r}{Z} dP_r - \int_0^{0.5825} \frac{P_r}{Z} dP_r$$

From Fig. 2b for $P_{r_1} = 1.143$ and $T_r = 1.4$

$$\int_0^{1.143} \frac{P_r}{Z} dP_r = 0.720$$

and Fig. 2a for $P_{r_2} = 0.5825$ and $T_r = 1.4$

$$\int_0^{0.5825} \frac{P_r}{Z} dP_r = 0.174$$

The reduced pressure integral then becomes:

$$\int_{0.5825}^{1.143} \frac{P_r}{Z} dP_r = 0.720 - 0.174 = 0.546$$

The pressure integral as obtained from the reduced pressure integral and critical pressure by means of Equation 14 therefore becomes:

$$\int_{0.5825}^{1.143} \frac{P}{Z} dP = (678.1)^2 (0.546) = 251{,}061$$

We are now ready to determine the capacity of the pipe line by means of Equation 12a, using the data previously given for the example:

$$Q_{day} = 109.6622 \frac{520}{14.65} \sqrt{\frac{(23.438)^5 (251{,}061)}{(0.0101)(0.632)(520)(100)}}$$
$$= 284{,}703{,}428 \text{ cu. ft. per day.}$$

It is of interest to make a comparison of the flow capacities indicated by the formula considering deviations from the ideal gas laws with those indicated by commonly used formulas. For the purpose of this comparison the gas analysis, pipe dimensions, length of line, temperatures, etc., of the preceding example will be used with the exception of entrance and exit pressures.

Fig. 5 shows estimated capacity of the pipe line for an exit pressure of 200 p.s.i. absolute plotted against entrance pressures up to approximated 1,500 absolute. Capacities have been estimated by Equations 12a and 13. Equation 12a considers deviations from ideal gas laws, while Equation 13 is a commonly used general equation based on ideal gas laws. The friction factor of 0.0101 as determined from Curve A Fig. 3 has been used in Equations 12a and 13. The friction factor of 0.0112 obtained from Weymouth's formula was also used

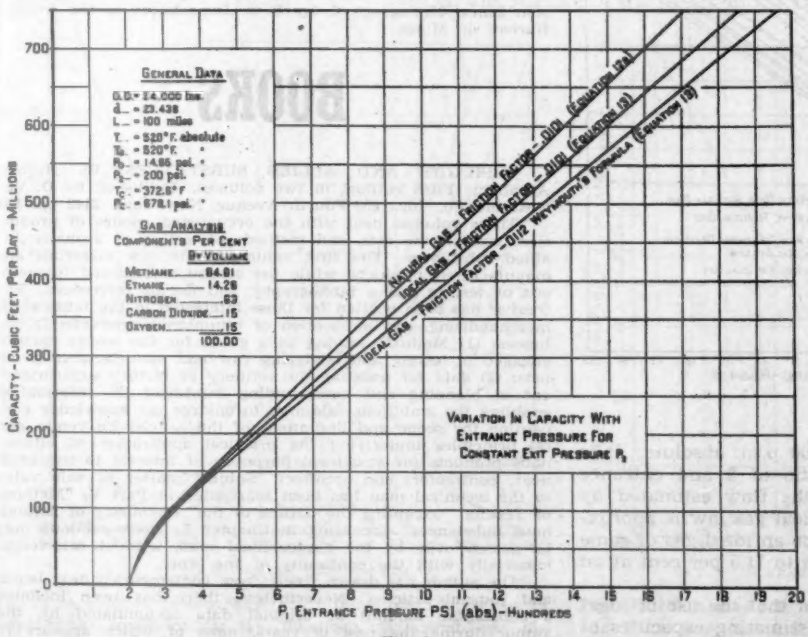
General Data
O.D. = 24.000 ins.
d = 23.438
L = 100 miles
T = 520° F. absolute
Ts = 520° F. "
Ps = 14.65 psi. "
P2 = 200 psi. "
Tc = 372.6° F "
Pc = 678.1 psi. "
Gas Analysis
Components Per Cent By Volume
Methane 84.81
Ethane 14.26
Nitrogen .63
Carbon Dioxide .15
Oxygen .15
100.00
Natural Gas – Friction Factor = .0101 (Equation 12a)
Ideal Gas – Friction Factor = .0101 (Equation 13)
Ideal Gas – Friction Factor = .0112 Weymouth's Formula (Equation 13)
Variation In Capacity With Entrance Pressure For Constant Exit Pressure P2
Capacity - Cubic Feet Per Day - Millions
P1 Entrance Pressure PSI (abs) - Hundreds
0
100
200
300
400
500
600
700
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20

*Fig. 5*

in Equation 13. It is seen that the ideal gas formulas result in a conservative estimate, the difference between capacities based on ideal gas laws and those based on formulas considering deviations therefrom, increasing with the entrance pressure.

.. Fig. 6 shows estimated delivery capacities for the same line as in Fig. 5 operating at a compression ratio of 2 for various entrance pressures. Again it is seen that the flow equations based on ideal gas laws result in lower estimates of capacity than the equation considering deviations from the ideal gas laws.

Dividing Equation 12a by Equation 13 provides a factor which represents the increase in flow estimated by the equation considering deviation from ideal gas laws from those based on ideal gas laws. A plot of the factor is shown in Fig. 7 as a family of curves for compression ratios from 1.2 to 10

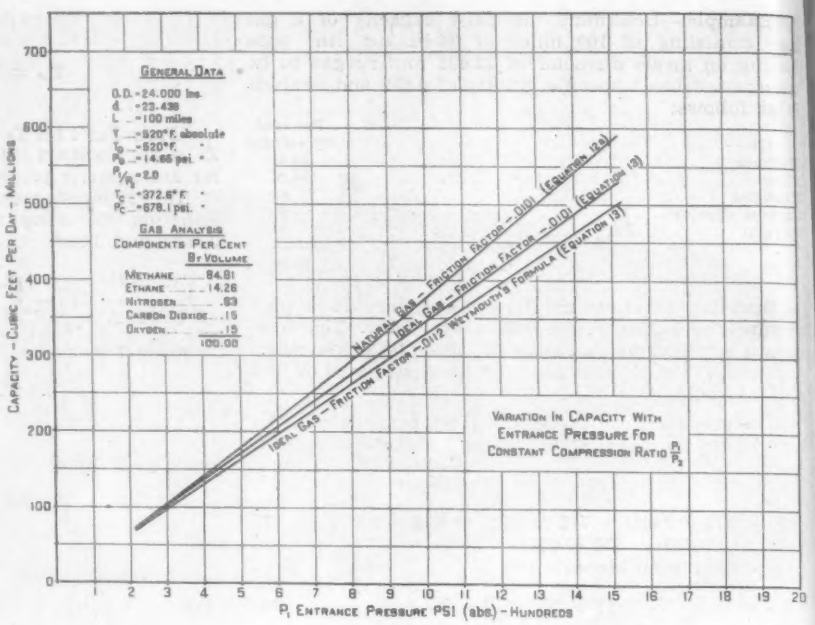
General Data
O.D. = 24.000 ins.
d = 23.438
L = 100 miles
T = 520° F. absolute
$T_b$ = 520° F.
$P_b$ = 14.65 psi.
$P_1/P_2$ = 2.0
$T_c$ = 372.6° F.
$P_c$ = 678.1 psi.
Gas Analysis
Components Per Cent By Volume
Methane 84.81
Ethane 14.26
Nitrogen .63
Carbon Dioxide .15
Oxygen .15
100.00
Natural Gas — Friction Factor = 0.01 (Equation 12a)
Ideal Gas — Friction Factor = 0.01 (Equation 13)
Ideal Gas — Friction Factor = 0.012 Weymouth's Formula (Equation 13)
Variation In Capacity With Entrance Pressure For Constant Compression Ratio $P_1/P_2$
Capacity — Cubic Feet Per Day — Millions
$P_1$ Entrance Pressure PSI (abs) — Hundreds

*Fig. 6*

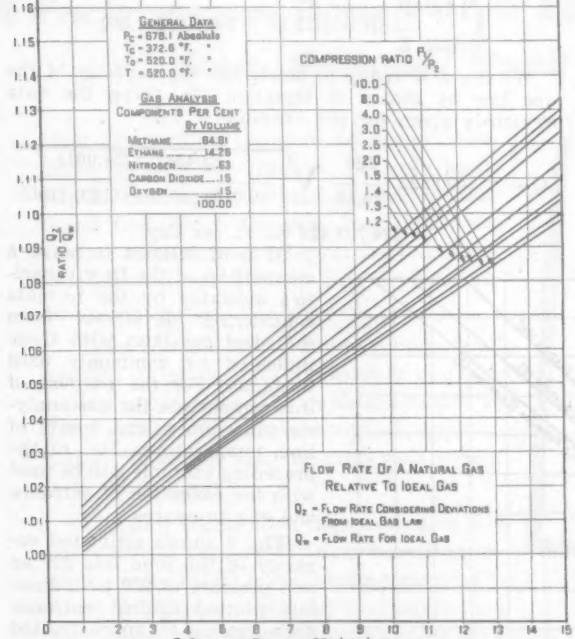


*Fig. 7*

for entrance pressures up to 1.500 p.s.i. absolute. It is seen that for a compression ratio of 2 and entrance pressure of 750 p.s.i. absolute, the flow estimated by considering deviation from the ideal gas law is approximately 6 per cent higher than for an ideal gas of same density. This difference increases to 11.5 per cent at an entrance pressure of 1,500 p.s.i.

In conclusion it may be stated that the use of ideal gas laws in flow equations for estimating capacities of natural gas lines is conservative. Considering deviations from the ideal gas laws, capacity is found to increase more rapidly with pressure than indicated by ideal gas flow equations. For pressures over 500 p.s.i. it would appear necessary to consider such deviations in order to arrive at the most economic design of a natural gas line. Such consideration is not difficult since calculations are facilitated by means of the curves of Figs. 1 to 3 inclusive.

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2. Chemical Engineers' Handbook, by John H. Perry, McGraw-Hill Book Co., New York.
3. Fluid Mechanics for Hydraulic Engineers, by Rouse, McGraw-Hill Book Co., New York.
4. Flow of Natural Gas Through High-Pressure Transmission Lines—Monograph 6, by U. S. Department of the Interior Bureau of Mines.


# BOOKS

ASPHALTS AND ALLIED SUBSTANCES. By Herbert Abraham. Fifth edition, in two volumes. Published by D. Van Nostrand Co., Inc., 250 Fourth Avenue, New York. 2142 pp. $20.

These volumes deal with the occurrence, modes of production, uses in the arts, and methods of testing of asphalts and allied substances. The first volume treats raw materials and manufactured products, while the second is confined to methods of testing and a bibliography and list of references. The treatise has been written for those interested in the fabrication, merchandising, and application of bituminous products. It embraces: (1) Methods serving as a guide for the works chemist engaged in testing and analyzing raw and manufactured products; (2) data for assisting the refinery or factory superintendent in blending and compounding mixtures; (3) information enabling the ambitious salesman to enlarge his knowledge concerning the scope and limitations of the articles he vends, and (4) principles underlying the practical application of bituminous products for structural purposes, of interest to the engineer, contractor, and architect. Subject matter of sole value to the technical man has been segregated in Part V, "Methods of Testing," excepting the outline of the "Chemistry of Bituminous Substances" appearing in Chapter 3. These sections may be passed over by the nontechnical man, without interfering materially with the continuity of the work.

The author has drawn freely from contemporary text books and journal articles. Nevertheless, there has been included a substantial amount of original data accumulated by the author during the past 19 years, most of which appears in print in these volumes for the first time.

# Displacement of Oil by Gas From a Point

*by Park J. Jones**

## Mechanics of Producing Oil, Condensate, and Natural Gas

**PART 22 OF A SERIES**

**Oil is displaced daily by gas in hundreds of reservoirs. The source of the gas may be gas caps, solution gas, and injected gas. Oil can be displaced because of pressure differences. It also can be displaced by gravity. But the effect of gravity, which can be the principal cause of oil displacement in some reservoirs, is not considered in this article.**

**Oil recovery by gas displacement from limestones and dolomites having secondary porosity is influenced by secondary structures. Solution gas and injected gas tend to bypass the oil in the comparatively smaller openings under certain conditions. Pays having secondary porosity are excluded from this article.**

**Relative permeabilities and interstitial water are used in estimating displacement of oil and gas-oil ratios. Curves are derived for oil recovery vs. produced gas-oil ratio from a point in a reservoir. The effect of variable pressure on oil recovery is beyond the scope of this article.**

### Experimental Relative Permeability

IN Fig. 22-1 are illustrated some relative permeabilities obtained experimentally[1] for displacement of liquids by gas. Relative permeabilities to liquids, $K_L$, and relative permeabilities to gas, $K_G$, are plotted against liquid-phase saturation. Three pairs of curves are shown. They are for samples of sand, sandstone, and limestone, respectively. Relative permeabilities to gas are high in comparison to those to liquids in the region from 30 per cent to 60 per cent liquid-phase saturation.

The pair of curves which intersect at 50 per cent saturation and 15 per cent relative permeability are for limestone samples having secondary porosity. The position of the point where relative permeability curves intersect for media having secondary structure depends on the porosity of the voids which are large relative to the porosity of the voids which are comparatively small. Fractures in sandstones have a similar effect on relative permeability curves. The initial point for the relative permeability to gas in limestone at 70 per cent liquid-phase saturation means that 30 per cent of porosity was invaded by gas before any gas passed through. The characteristics of media have a significant effect on gas-oil ratios and displacement of oil by gas.

*Production consultant, Houston.

### Interstitial Water vs. Oil Recovery

Recovery of oil by displacing reservoir liquids with gas depends on the characteristics of pay. But pay characteristics are such that their interstitial water content ranges from about 5 per cent up to about 65 per cent. Most of this 13-fold variation is believed to be caused by the composition and texture of the media in which oil is found. Conversely, interstitial water characterizes a pay.

It is believed that interstitial water gives more information than any other single parameter on (1) the quantity of oil in place, (2) oil recovery by gas displacement, (3) available rate of oil recovery by gas displacement, and (4) the gas-oil ratio of the production. Accordingly, interstitial water is used as a factor in estimating displacement of oil by gas.

### Effect of Gravity and Texture on Oil Recovery

Oil recovery by gas displacement

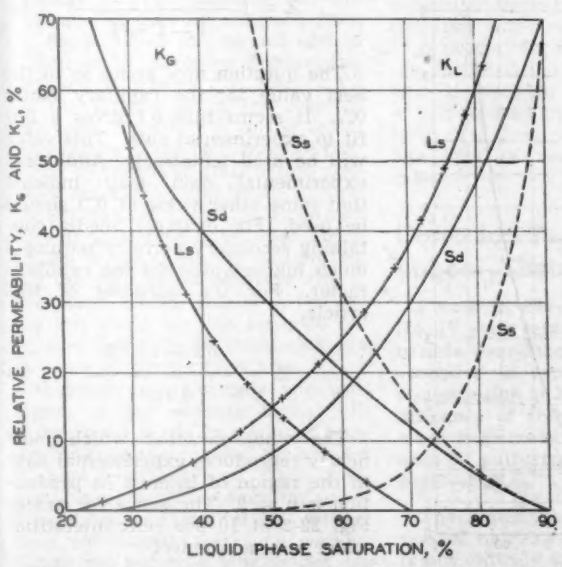


*Fig. 22-1—Relative permeability ($K_L$) to liquid and ($K_G$) to gas vs. liquid-phase saturation for (Ls) limestone, (Sd) sand, and (Ss) sandstone. After Botset with additions*

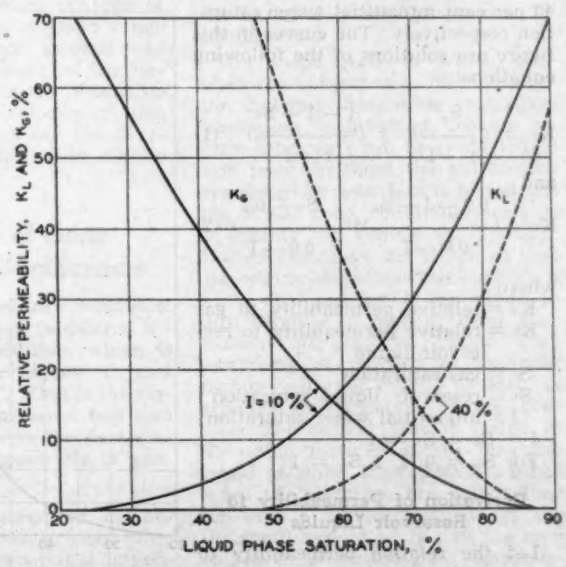


*Fig. 22-2—Computed relative permeability ($K_L$) to reservoir liquid and ($K_G$) to gas vs. liquid-phase saturation in pays containing 10 and 40 per cent interstitial water respectively*

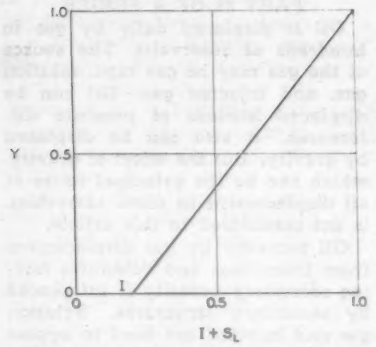


*Fig. 22-3—Illustrating the method used for estimating relative permeability to reservoir liquid*

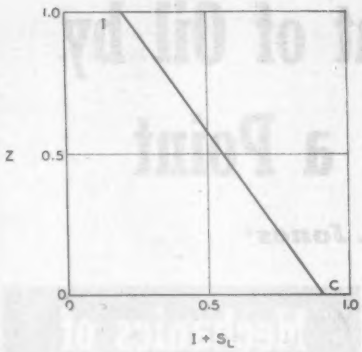


*Fig. 22-4—Illustrating the method used for estimating relative permeability to gas*

is influenced by gravity and texture of media. Oil recovery by gravitational segregation of gas relative to reservoir liquids can be anywhere from 100 per cent to 200 per cent higher than the recovery of oil by straight gas displacement. Only straight gas displacement is considered in this article.

Pays containing secondary structure like solution channels and stylolites in limestones and dolomites and fractures in sandstones influence oil recovery by gas displacement. Aside from the effect of gravity, recovery of oil by evolved solution gas and by injected gas is influenced by secondary openings. In both cases, the gas tends to bypass oil. This article is limited to pays having primary porosity. Pays containing secondary porosity are not included.

### Computed Relative Permeability

Fig. 22-2 illustrates computed relative permeabilities to reservoir liquids and gases for 10 per cent and 40 per cent interstitial water saturation respectively. The curves in this figure are solutions of the following equations:

$$K_L = \left(\frac{S_L}{1-I}\right)^3 = \left(\frac{1-I-S_G}{1-I}\right)^3 \quad (1)$$

and

$$K_G = \left(\frac{0.9-I-S_L}{0.9-I}\right)^2 = \left(\frac{S_G-0.1}{0.9-I}\right)^2 \quad (2)$$

where

$K_G$ = relative permeability to gas
$K_L$ = relative permeability to reservoir liquid
$S_G$ = gas saturation
$S_L$ = reservoir liquid saturation
I = interstitial water saturation
$I + S_G + S_L = 1$
For $S_G = 0$; $I + S_L = 1$

### Derivation of Permeability to Reservoir Liquids

Let the relative permeability to reservoir liquids for gas displacement be defined by

$$K_L = y^n \quad (3)$$

where

y = a quantity to be found
n = a number

The problem is to find a quantity y which, when raised to the nth power, reproduces experimental data on relative permeability to reservoir liquids. The reproduction need not extend beyond the region of interest in practice.

In Fig. 22-3, the relative permeability at 100 per cent liquid-phase saturation (interstitial water plus reservoir liquid) is one. Whereas, the relative permeability to reservoir liquid at interstitial water saturation, I, is zero. The equation of a line connecting these two points is

$$y = \frac{S_L}{1-I} \quad (4)$$

Accordingly,

$$K_L = y^n = \left(\frac{S_L}{1-I}\right)^n$$

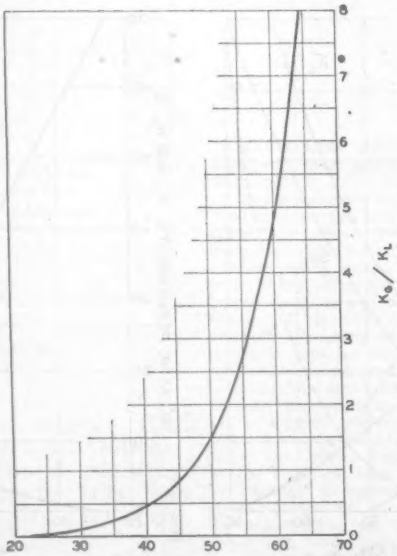


*Fig. 22-5—Permeability ratio vs. per cent oil recovery from a point*

The whole number which most nearly reproduces experimental data in the region of interest to production is n = 3. The $K_L$ curve in Fig. 22-2 for 10 per cent interstitial water is a solution of

$$K_L = \left(\frac{S_L}{0.9}\right)^3 = \left(\frac{0.9-S_G}{0.9}\right)^3 \quad (5)$$

and the one for 40 per cent interstitial water, of

$$K_L = \left(\frac{S_L}{0.6}\right)^3 = \left(\frac{0.6-S_G}{0.6}\right)^3 \quad (6)$$

### Derivation of Permeability to Gas

Let the relative permeability to gas be defined by

$$K_G = Z^n \quad (7)$$

where

Z = a quantity to be found
n = a number

The problem is to find a quantity Z which, when raised to the nth power, reproduces experimental data in the region of interest to production.

In Fig. 22-4, the relative permeability to gas at interstitial water saturation, I, is assumed to be one. Whereas, the relative permeability to gas at liquid phase saturation (1 — C) is assumed to be zero. The quantity, C, is a correction factor for capillarity. It probably varies with the characteristics of pay and the surface properties of reservoir liquids. The equation of the line connecting the two points is

$$Z = \left(\frac{1-C-I-S_L}{1-C-I}\right) \quad (8)$$

The question now arises as to the best value for the capillary factor (C). It seems that 0.1 gives a fair fit to experimental data. This value will be used tentatively. Additional experimental data may indicate that some other value of (C) should be used. For example, media containing secondary porosity require a much higher value for the capillary factor. For the purposes of this article,

$$Z = \frac{0.9-I-S_L}{0.9-I} \quad (9)$$

The whole number which most nearly reproduces experimental data in the region of interest in production is n = 2. The curve for gas in Fig. 22-2 at 10 per cent interstitial water is a solution of

$$K_G = \left(\frac{0.8-S_L}{0.8}\right)^2 \quad (10)$$

# QUESTIONS on TECHNOLOGY

**by W. L. Nelson**
Consulting Engineer

## Soaking Factor In Cracking

**On the January 6 issue of this page a question was presented about the term "soaking factor." Walter E. Lobo of the M. W. Kellogg Co. is the originator of the term and he has been good enough to assist us in defining it.**

The soaking factor is used by several of the large oil refiners and by the M. W. Kellogg Co. as a means of judging the performance of cracking furnace coils and in the control of plant operations. By definition:

$$F = \frac{\text{cu. ft. coil volume (above 800°F.)}}{\text{B.P.D. coil charge @ 60°F.}} \times \frac{\text{mean KT}}{K_{800\ \text{deg. F.}}}$$

in which

F = soaking factor

$\frac{\text{mean KT}}{K_{800\ \text{deg. F.}}}$ = average rate of reaction referred to 800° F. obtained by integration of $\frac{KT}{K_{800\ \text{deg. F.}}}$ over the part of the coil that is above 800°F.

Values of the reaction velocity constant (K) may be obtained from Fig. 94, p. 306 of the second edition of Petroleum Refinery Engineering (McGraw Hill Book Co., Inc., N. Y.) and the integration of the reaction ratio term from 800°F. to the outlet temperature of the coil could be conducted by means of an equation generally similar to that given (Equation 66) on page 317 of the same volume. It should be noted that Equation 66 is based on the assumption that the rate of temperature rise is a constant, which usually is not the case but which is often assumed because of difficulty in evaluating the true rate of temperature rise.

Obviously the accuracy and usefulness of the soaking factor will be improved if the true rate of temperature rise is computed for a series of short lengths of coil. This, however, involves the computation of volumes in and around the critical point (or range), and such computations are not only tedious but are not entirely reliable.

Lobo comments as follows:

"Soaking factors are correlated at a standard pressure and corrections for other mean operating pressures are applied. In thermal gas-oil cracking and visbreaking the soaking factor is correlated against the per cent crack per pass (basis 400°F. end point and 100 per cent $C_4$ recovery). In the case of naphtha reforming it is correlated against the octane number improvement as a function of the octane number of the charge.

The use of such correlations would be:

1. To fix the soaking volumes required in furnace design to crack a given feed stock under definite conditions;

2. To estimate the changes in operating conditions, such as temperature or pressure or both, required in existing furnaces to effect a definite change in crack per pass;

3. To estimate the probable crack per pass in an existing furnace, particularly in a combination unit where other methods are not available.

4. As an aid in setting up laboratory coils and coil throughputs when laboratory work is to be performed on a new feed stock."

Obviously the factor would be very useful if adequately correlated against plant operations, particularly if each correlation is confined to a particular type of plant or type of cracking still and to a short range of pressure. In a most general way the factor is a measure of the extent of cracking because it consists of the product of a velocity or time term (the first ratio) and the average rate of reaction (the second ratio).

## Corrosion Tests of Gear Lubes—Their Significance

**I note in the Refiner's Notebook No. 17 your reference to dibenzl disulfide gear-lube additive, which is corrosive to copper at 300° F. and noncorrosive at 212°. What is the significance of this corrosion test and what is its relation to the performance of sulfurized gear oils in general?—H.H.S.**

The exact mechanism of the action of extreme-pressure gear lubes is not entirely known but it is generally accepted that they must be corrosive at the conditions under which they are used. This is true of the chloride-base lubricants as well as the sulfur-base ones. Many specifications for gear lubes, notably those of the U.S. Army and Navy, require that the oils be corrosive to copper when the test is conducted at 300°-350° F. but that they must not be seriously corrosive to iron or steel at ordinary gear-box temperatures. Some specifications even require that these oils be noncorrosive to copper at 212°.

The reason for requiring an oil that is noncorrosive at ordinary temperatures is quite evident, namely that the lubricant should not destroy the gear box, its housing or the gears contained in it. Why the gear lube should be corrosive at elevated temperatures is not as definite but the following is the general theory by which gear lubes are thought to function.

As the teeth or surface of the gears rub against one another heat is generated. The hottest spots are those that scratch against one another or in other words, the high or rough spots. The reason that these spots get hot is that the entire load is being carried on the high spots and they do not expose enough area to carry the load without overheating. Under these conditions the high spots are corroded or eaten away by the gear-lube additive material so that more and more surface is exposed to the load as the load increases. Thus, the corrosive additive in the gear lube acts as an automatic agent for smoothing or grinding the surfaces to whatever degree of smoothness or contact surface may be required to carry the load. In one sense, the action may be thought of as a chemical means of polishing by which a degree of smoothness surpassing anything now possible by mechanical means can be accomplished.

The shock tests to which gear lubes are subjected is clear indication that something other than plain lubrication is involved because no other lubricants can be subjected to such tests. In these the automotive equipment or gear box is tested under actual road conditions such as to operate the vehicle at 75 m.p.h. to then disengage the clutch so that the engine stops moving, and then while still moving at 65 m.p.h. to shift directly to high or third gear without starting the engine. Any scratching or scuffing of the gear surfaces during such a test is grounds for rejection of the gear lube. The second gear is tested in the same manner except that the speed is only 45 m.p.h. No other types of lubricants are satisfactory for such a service particularly for the small hypoid gears that are now employed in automotive transmissions. Refer to Army Specifications 2-105 and the specifications of General Motors.

# Determination of the Composition Of Commercial Isobutane

*by J. W. Tooke and R. P. Roberts*

DURING recent times isobutane has assumed a position of national importance. Its place in the various processes for the manufacture of aviation fuels is well known. The control of these processes for maximum production is, in a large measure, dependent upon an accurate knowledge of the composition of the various streams containing isobutane. The usual control tests are precision fractional analysis or various modifications of the simple weathering test. Both methods offer serious objections, the former because of its complexity and slowness and the latter because of its inaccuracy.

The method of analysis described here is based upon the same principles as used by Hachmuth and Tooke* for the determination of the composition of commercial isopentane. The test is performed rapidly and accurately. Usually a test may be completed and results reported in 45 minutes. The average accuracy is ±0.25 per cent for propane and pentane and ±1.0 per cent for isobutane and normal butane.

*J. W. TOOKE*

*R. P. ROBERTS*

**Following his formal education at Louisiana State University and Centenary College, Tooke was employed as a chemist in plants producing chemicals from oil-field brines from 1930 to 1935. In the latter year he joined the research staff of Phillips Petroleum Co. In 1940 he was made section chief of the manufacturing section and in that capacity has been closely associated with the development of pure hydrocarbons.**

**Roberts graduated from Texas Technological College and went to work at the Borger, Tex., refinery of Phillips as a chemist in the control laboratories. He has held various positions in the laboratory, and is at present in charge of the hydrocarbon analysis section.**

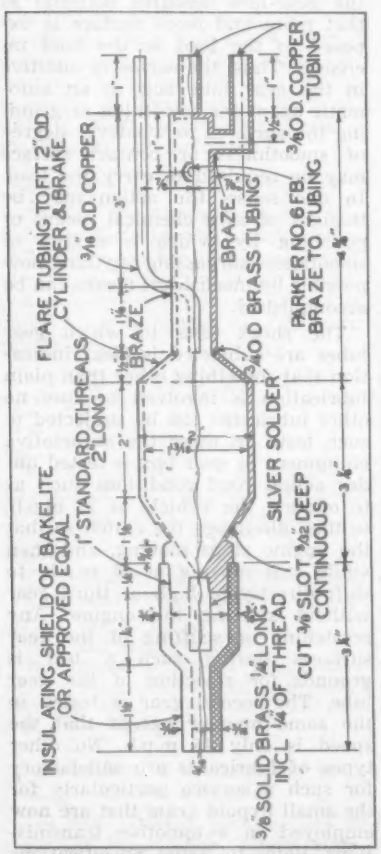
FLARE TUBING TO FIT 2" OD. CYLINDER & BRAKE
3/16 O.D. COPPER
1" STANDARD THREADS 2" LONG
BRAZE
INSULATING SHIELD OF BAKELITE OR APPROVED EQUAL
3/8" SOLID BRASS 1/4" LONG INCL 1/4" OF THREAD
CUT 3/16 SLOT 3/32" DEEP CONTINUOUS
SILVER SOLDER
3/8 O.D. BRASS TUBING
BRAZE
PARKER NO. 6 FB. BRAZE TO TUBING
3/8 O.D. COPPER TUBING

*Fig. 1—Distillation flask for analysis of butane*

### Apparatus

The apparatus consists of:

1. A special distillation flask. The flask shown in Fig. 1 is made of brass. All parts are closely machined to insure uniform dimensions and mass of metal.

2. A special cooling jacket. The jacket shown in Fig. 2 is made of 24-gage sheet copper, ⅛-in. o.d. copper tubing and ⅜-in. o.d. copper tubing. The completed jacket is insulated with a 1-in. thickness of suitable insulating material. The entire apparatus is supported on a bottom cover plate and air currents around the distillation flask are reduced by a top cover plate. The construction of the top and bottom cover plates are shown in Fig. 3.

3. A 30-in. mercury manometer.

4. A precision mercury distillation thermometer. Length 15 in., graduations —40° to +80° F. by 0.2° F.

5. A mercury thermometer for measuring jacket temperature, length 12 in., graduation —40° to +120° F. by 1.0° F.

6. An electric heater. Made from 23 in. of No. 28 B&S gage chromel A wire imbedded in Insulute cement.

7. An ammeter. Range 0-3 ampere a.c.

8. A transformer, 110-volt a.c. 12-18-volt variable secondary.

9. A timer. 100 seconds for revolution.

10. A sample container of suitable size and of sufficient strength to contain propane.

11. An aspirator bulb.

12. A means of cooling the cooling jacket to subzero temperatures.

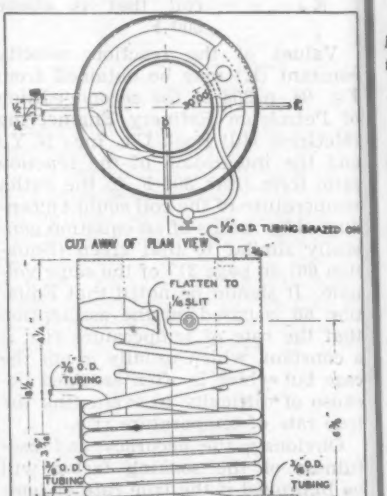
½ O.D. TUBING BRAZED ON
CUT AWAY OF PLAIN VIEW
FLATTEN TO ⅛ SLIT
⅜ O.D. TUBING
⅜ O.D. TUBING
⅜ O.D. TUBING
CUT AWAY OF FRONT ELEVATION
NOTE ALL CORNERS TO BE BRAZED.
ALL TUBING TO BE COPPER.
INSIDE & OUTSIDE SHELLS TO BE COPPER.
ALL TUBING PASSING THROUGH EITHER SHELL TO BE BRAZED.

*Fig 2—Detail of special cooling jacket*

*"Determination of the Composition of Commercial Isopentane," Hachmuth and Tooke, National Petroleum News, May 1, 1940.

temperature are again observed and recorded.

**Interpretation of test.** — The observed values used in the interpretation of the test are the 10 ($t_{10}$), 20 ($t_{20}$), 50 ($t_{50}$) per cent temperatures and the end-point temperature ($t_{EP}$). The temperatures $t_{10}$, $t_{20}$ and $t_{50}$ are obtained by interpolation of the temperature-time distillation curve when the initial temperature is zero per cent distilled and the end-point temperature is 100 per cent distilled.

The temperatures $t_{20}$ and $t_{EP}$ are corrected for variations in barometric pressure and emergent thermometer stem by use of Figs. 4 and 5 respectively. Fig. 5 is valid only for the type of precision thermometer described under apparatus.

The temperature increment, $t_I$, between $t_{10}$ and $t_{50}$ is obtained as follows: $t_I = t_{50} - t_{10}$.

## Results

The volume per cent of pentane in the sample is obtained by locating $t_{EP}$ on the ordinate of Fig. 6, tracing its intersection with the appropriate curve and reading the volume per cent of pentane on the abscissa.

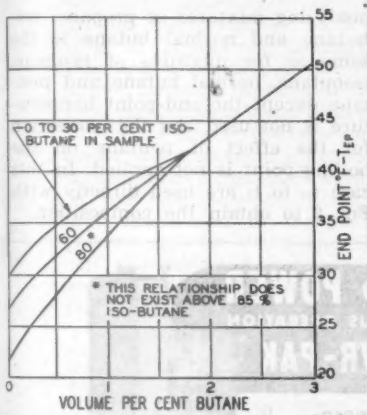


*Fig. 6—Correlation of end-point temperature with pentane content*

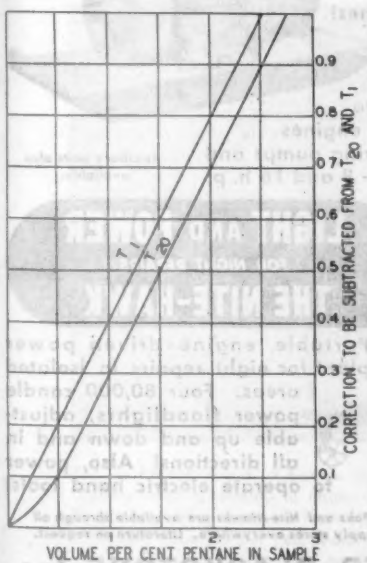


*Fig. 7—Correction to be applied to $t_{20}$ and $t_I$ when pentanes are present in sample*

To obtain the volume per cent of propane, isobutane and normal butane in the sample a further correction of $t_{20}$ and $t_I$ is necessary to compensate for the presence of pentane. These corrections are made using Fig. 7. The volume per cent of pentane in the sample is located on the abscissa, the point traced to the appropriate curves and the value to be subtracted from $t_{20}$ to $t_I$ obtained from the ordinate. These values, thus determined are located as closely as can be estimated on the isothermal 20 per cent ($t_{20}$ and 5 — 10 per cent, $t_I$) temperature lines of Fig. 8. The ordinates of the point so located are then read, giving the volume per cent propane and isobutane in the sample. The sum of the three values thus determined subtracted from 100 give the volume per cent of normal butane in the sample.

The average accuracy of the method is ±0.25 per cent for propane and pentane and ±1.0 per cent for isobutane and normal butane.

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### Basis of the Test

This method of test is dependent upon obtaining a true and accurately measured boiling point curve for the sample tested. The boiling point of the butanes is less than ordinary room temperatures, therefore, to eliminate the inaccuracies caused by heat flow from the atmosphere to the thermometer registering the vapor temperatures of the boiling sample, the special cooling jacket described in this paper was devised. The use of the precision thermometer insures the observance of very small changes in temperature.

It is not convenient to distill and condense butane to obtain a temperature-volume distillation curve, therefore this test has been based on a temperature-time distillation curve. Because of the empirical nature of the test it is important that apparatus comply with specifications and that the procedure set forth be adhered to, otherwise the calibration curves are considerably less accurate.

In using this method it should be understood that it is applicable only to mixtures of propane, isobutane, normal butane and pentane. The presence of any other compound in the sample will invalidate the results. To determine the accuracy of this test, synthetic blends of known composition were analyzed. The results of some of these tests are given in Table 1.

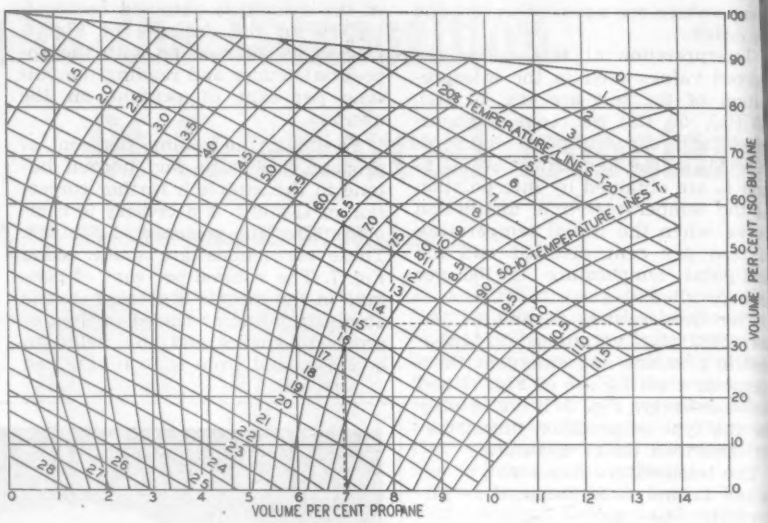


*Fig. 8—20 per cent and 50-10 per cent distillation temperature °F. for mixtures containing propane, isobutane, n-butane (with corrections) $t_{20}$ and $t_1$*

### Application to Other Butane Mixtures

While this test is intended primarily for determination of the composition of commercial isobutane other butane mixtures may be analyzed as well. The procedure for analyzing mixtures of propane, isobutane and normal butane is the same as for mixtures of propane, isobutane, normal butane and pentane except the end-point temperature is not used and the correction for the effect of pentane on the boiling point is not applied. In this case $t_{20}$ to $t_1$ are used directly with Fig. 8 to obtain the composition.

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Engineering Fundamentals No. 180

A FEATURE OF THE OIL AND GAS JOURNAL

# Use of Surface-Active Chemicals to Increase Oil Ratios and Reduce Emulsification in Oil Wells

**EXPERIENCE with wetting agents.**—It has been shown that certain organic compounds like aerosol have the property of lowering the interfacial tension between oil and water (Engineering Fundamentals No. 174). Garrison[1], Bonnet[2], Livingston[3], and others considered that the addition of a few parts per million of these organic compounds to water in the bottom of a well might reduce surface tension and perhaps prevent capillary spreading* of water around the periphery of a well. (Fig. 1.) It was also thought that injecting a solution of a surface-active chemical back into an oil sand containing a water cone might reduce the size of the cone and increase the amount of oil produced. Surface-active chemicals were tried in the laboratory by Livingston[4] and others and in the field by Bonnet and by Vietti and Garrison[5]. Livingston found that small amounts of wetting agents injected into water flowing through a sand containing oil and water in a special type of artificial oil reservoir containing water cones markedly increased the amount of oil produced.

Bonnet[2] carried on certain field experiments on the use of wetting agents introduced into oil wells producing oil and water, and Vietti and Garrison[5] tried injecting active agents into the producing sand. These experiments showed some promise but no great success. The great difficulty in treating reservoir water in the field is the problem of inventing a cheap method to continually inject the wetting agent into the water portion of the sand. Once injected directly into the sand of a producing well, the chemical is soon washed back into the hole and its effect is lost unless continually renewed. It is thought that where water is being returned to the edges of water drive reservoirs, the addition of a little wetting agent to the water being injected might eventually find its way back into edge wells and tend to increase oil-water ratios. As far as known, no experiments of this kind have been tried.

**Function of wetting agents.**—The chief application of wetting agents in production, therefore, is (1) making more complete separation of oil and water in the hole, (2) preventing emulsification, and (3) preventing water spreading from the well into the oil sand. Occasionally wells need to be shut down for repairs, and then fluid rises in the hole until static conditions are reached, a column of water separates in the bottom of the well, and in many places remains for some time opposite the oil sand. If, at such periods, a weighed soluble capsule containing a concentrated charge of a wetting agent is dropped in the hole and the fluid stirred when withdrawing the tubing, the tendency for water spreading back into the sand will be lessened.

Application of surface-active chemicals to mud fluid left standing in contact with oil sands is also probably helpful as pointed out by Bonnet[2], and the application of the same chemicals to acid being used to clean holes and to treat calcareous oil formations has proved beneficial. If untreated acid water is forced into fine capillaries, it is likely to persist, at least to some extent, in the sand. Some have advocated continually adding small quantities of wetting agents into the annular space between tubing and casing so that the fluids being pumped will be treated at all times, emulsification lessened, and water spreading into the sand reduced. Such a procedure costs little and saves treating the fluids in the gun barrel or flow tanks. Means should be devised to mix the chemical thoroughly with the water.

*The term capillary spreading is used here in an oil-field sense; i.e., the penetration of water into sand around an oil well to form a sheath of excess water. Technically, spreading pressure due to capillary forces means change in free surface energy. See Livingston[3].

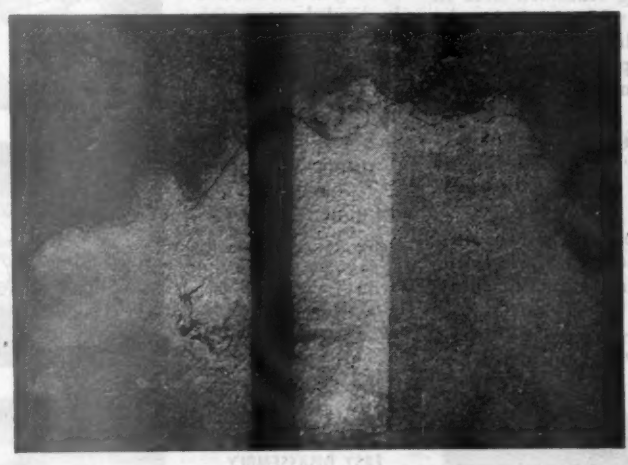


*Fig. 1—Photograph of a section through an oolitic limestone reservoir rock showing "coning" and spreading of water around an artificial well set up in the laboratory. The light portion is mostly water; the dark portion is mostly oil. Originally, the rock contained about 50 per cent water and 50 per cent oil, and the oil-water contact was horizontal across the halfway point in the sand*

**References**

1. Garrison, A. D., Selective Wetting of Reservoir Rocks and Its Relation to Oil Production: The Oil and Gas Journal, vol. 34, pp. 36-39, August 15, 1935.
2. Bonnet, C. F., Treatment of Oil Sands With Surface-Active Chemicals: A.P.I. Prod., Bull. 227, pp. 23-33, 1941.
3. Livingston, H. K., Surface Energy Relationships in Petroleum Reservoirs: Trans. A.I.M.E., vol. 151, pp. 147-152, 1943.
4. Plummer, F. B., and Livingston, H. K., Water Cones and Water Sheaths in Experimental Oil Wells: A.A.P.G. Bull., vol. 24, pp. 2163-2179, December, 1940.
5. Vietti, W. V., and Garrison, A. D., U. S. Patent No. 2,024,119, December 10, 1935.

Series prepared by F. B. Plummer, professor, petroleum engineering school, University of Texas.

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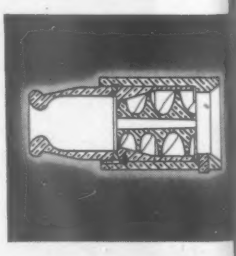

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# The Refiner's Notebook

A WEEKLY FEATURE OF THE OIL AND GAS JOURNAL

## Sulfur Analysis

THE Bureau of Mines method outlined here is given in detail in R.I. 3591 (Determination of Types of Sulfur Compounds . . .) by John S. Ball, December 1941.

**L-1 total sulfur.** — Determine by lamp method D90-41T of the A.S.T.M. except use Ethyl Corp. lamp (I.E. Ch. Anal. Ed. 2,104, 1930) without air-purification feature, use isooctane instead of alcohol for the blank, use fluorescent light for titration, and compute sulfur from difference between sample and blank.

**T-1 mercaptans and hydrogen sulfide.**—Pipette 10 ml. of oil into Erlenmeyer flask and add excess (estimated) of $AgNO_3$ solution from burette. Add several drops ferric alum and shake. (If black sulfide upon adding $AgNO_3$, an excess of $AgNO_3$ must be added before ferric alum is introduced to prevent oxidation of hydrogen sulfide.) Shake violently while adding ammonium thiocyanate from a burette until water layer retains pink end-point color. Attainment of pink color with a few drops indicates more $AgNO_3$ must be added. Break any emulsion formation with a few drops of alcohol as end point is approached. One ml. $AgNO_3$ is added and the solution is again brought to pink with thiocyanate. The $AgNO_3$ that reacts with the oil is the difference in volume of $AgNO_3$ used and thiocyanate (times a factor of 0.996) used. Check the amount of $AgNO_3$ used by adding 1 ml. $AgNO_3$ and retitrating with thiocyanate until three values that check within 0.05 ml. of $AgNO_3$ are obtained. Per cent sulfur in form of mercaptans and hydrogen sulfide, is:

$$\frac{\text{ml. } AgNO_3 \text{ reacting} \times \text{normality } AgNO_3 \times 3.206}{\text{ml. oil} \times \text{sp. gr. of oil}}$$

**T-2 mercaptans.** — If qualitative test with cadmium chloride shows hydrogen sulfide by a yellow precipitate, shake 125 ml. oil with same volume of cadmium chloride solution in a separatory funnel. The water layer is withdrawn and a $AgNO_3$ titration as in Operation T-1 above is made on 10 ml. of the treated oil. A large amount of free sulfur obscures the end point and it may be removed from the treated oil by shaking with mercury and filtering. The ml. $AgNO_3$ used in titration T-2 represents mercaptans. Hydrogen sulfide is represented by T-1 minus T-2 divided by 2.

**T-3, T-4, T-5, T-6, elementary sulfur.** — To 50 ml. of cadmium treated oil add 1 ml. butyl mercaptan solution for each 0.02 per cent free sulfur. A titration (see T-1 above) called T-3 is made on 10 ml. of the mixture. The remaining mixture is shaken with 10 ml. of plumbite solution and after settling, the clear portion is carefully drawn off. The oil is shaken with 25 ml. sulfuric acid solution until the original color of the oil is restored. The acid layer is drawn off, the oil is washed with 25 ml. of cadmium solution, and titration T-4 with $AgNO_3$ is made on the oil. The sulfur T-3 less the sulfur by T-4 divided by 2 is elementary sulfur except for the small correction (subtracted) for the blank test which follows.

A blank test on cadmium-treated oil is subtracted from the above. Shake the oil with metallic mercury until no further discoloration occurs, and filter through two quantitative filter papers. The oil is then tested (50 ml.) exactly as outlined above calling the two titrations T-5 and T-6. The difference in T-5 and T-6 divided by 2 should be subtracted from the free sulfur found above.

**L-2 check free sulfur.**—150 ml. of fresh sample is shaken with mercury until reaction is complete and the sulfur content of the oil is determined by a lamp test, called L-2, and conducted just as Operation L-1. Sulfur by L-1 less that by L-2 is elementary sulfur.

**L-3 check on mercaptans and sulfide.**—Remove RSH and $H_2S$ by shaking mercury-treated oil with an equal volume of $AgNO_3$ solution until no further reaction occurs. Wash the oil three times with equal volumes of water and test with $AgNO_3$ to be sure treatment is complete. Determine sulfur by lamp test L-3. The difference in L-2 and L-3 is the mercaptan and hydrogen sulfide sulfur. If this value is greater than sum of the hydrogen sulfide, mercaptans and water-soluble compounds (see L-6 later) the excess is added to the aliphatic sulfides (found later).

**T-7 disulfides.** — 50 ml. of the mercury and $AgNO_3$ treated oil is refluxed in an Erlenmeyer flask with 10 gm. zinc and 50 ml. acetic acid for 3 hours. After cooling and separating the zinc, the oil-acid mixture is diluted with 250 ml. of water. A 10-ml. sample of the oil layer is titrated with $AgNO_3$ and the sulfur by T-7 is the disulfide sulfur.

**L-4 aliphatic sulfides.**—The remaining mercury and $AgNO_3$ treated oil is shaken with a third its weight of mercurous nitrate and filtered. This treatment is repeated twice and the oil is washed thrice with equal volumes of water. Filtered oil from this treatment is tested by lamp, Operation L-4, and the difference between L-3 and L-4 is aliphatic sulfides except for a possible increase from test L-3 mentioned thereunder.

**L-5 aromatic sulfides and thiophenes.**—Oil remaining from mercurous nitrate treatment is shaken twice with mercuric nitrate (as above with mercurous nitrate) and washed thrice with water. Test the filtered oil by lamp (L-5) and the aromatic sulfides and thiophenes are represented by L-4 minus L-5 and minus T-7.

Unaccounted for or residual sulfur is that given by L-5.

**L-6 water-soluble compounds.**—If check L-3 indicates more hydrogen sulfide and mercaptans than titration T-1, wash the fresh oil thrice each time with an equal volume of water, and test the filtered oil by lamp (L-6). The difference in L-1 and L-6 is water-soluble sulfur.

No. 36 in a series by W. L. Nelson, professor of petroleum refinery engineering, University of Tulsa

| I. ORIGINAL SAMPLE — 350 ML. | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 4. TREAT 125 ML WITH ACID $CdCl_2$ SOLUTION. SEPARATE OIL AND FILTER | | | | | 15. TREAT 150 ML. WITH METALLIC MERCURY. | | | | | 25. WASH WITH WATER |
| | | 5. IF YELLOW PPT. FORMS | 7. ADD BUTYL MERCAPTAN | | 11. TREAT WITH Hg. ADD BUTYL MERCAPTAN | | | 17. SHAKE WITH 0.05N. $AgNO_3$ | | | | | |
| | | | | 9. TREAT WITH PLUMBITE, $H_2SO_4$, ACID $CdCl_2$ SOLUTION | | 13. TREAT WITH PLUMBITE, $H_2SO_4$, ACID $CdCl_2$ SOLUTION | | | 19. REDUCE 50 ML. WITH Zn AND ACETIC ACID | 21. SHAKE WITH MERCUROUS NITRATE | 23. SHAKE WITH MERCURIC NITRATE | |
| 2 DETERMINE LAMP SULFUR | 3. MAKE $AgNO_3$ TITRATION | 6. MAKE $AgNO_3$ TITRATION | 8 MAKE $AgNO_3$ TITRATION | 10. MAKE $AgNO_3$ TITRATION | 12 MAKE $AgNO_3$ TITRATION | 14 MAKE $AgNO_3$ TITRATION | 16. DETERMINE LAMP SULFUR | 18. DETERMINE LAMP SULFUR | 20. MAKE $AgNO_3$ TITRATION | 22. DETERMINE LAMP SULFUR | 24. DETERMINE LAMP SULFUR | 26. DETERMINE LAMP SULFUR |
| OPERATION L-1 | OPERATION T-1 | OPERATION T-2 | OPERATION T-3 | OPERATION T-4 | OPERATION T-5 | OPERATION T-6 | OPERATION L-2 | OPERATION L-3 | OPERATION T-7 | OPERATION L-4 | OPERATION L-5 | OPERATION L-6 |
| TOTAL SULFUR | $H_2S$ & MERCAPTANS | MERCAPTANS | FREE OR ELEMENTARY SULFUR | | | | CHECK ON FREE SULFUR | APPROX CHECK ON $H_2S$ & RSH | DISUL-FIDES | ALIPHATIC SULFIDES | AROMATIC SULFIDES & THIO-PHENES | WATER-SOLUBLE SULFUR COMPOUNDS |

## CALCULATIONS

**Hydrogen sulfide.** Given by $\frac{T1 - T2}{2}$

**Mercaptans.** When hydrogen sulfide is present as shown by yellow precipitate on treatment with cadmium chloride, mercaptans are given by T2. When hydrogen sulfide is not present, mercaptans are given by T1. A check on hydrogen sulfide and mercaptans is given by L2—L3.

**Elementary sulfur.** Given by $\frac{(T3 - T4) - (T5 - T6)}{2}$

A check is given by L1—L2.

**Disulfides.** Given by T7.

**Aliphatic sulfides.** Given by L3—L4. As silver nitrate removes some of the lighter sulfides, a correction should be made if L2—L3 is greater than

$$\frac{T1 - T2}{2} + T2 + L1 - L6$$

(hydrogen sulfide and mercaptans plus water-soluble sulfur compounds).

**Aromatic sulfides and thiophenes.** Given by L4—L5—T7.

**Water-soluble sulfur compounds.** Given by L1—L6.

**Residual sulfur.** Given by L5.

## REAGENTS

**Sodium carbonate solution,** 3.306 gram carbonate per liter (1 ml. equivalent to 1 mg. S).

**Hydrochloric acid,** 10 ml. of which exactly neutralizes 10 ml. of carbonate.

**Silver nitrate solution,** 0.05 normal, standardized against sodium chloride.

**Ammonium thiocyanate solution,** 0.05 normal.

**Ferric alum indicator,** 40 gram ferric alum and 20 ml. of 6 normal nitric acid made up to 100 ml., boiled to remove nitrogen oxides and diluted 3:1 for indicator solution.

**Cadmium chloride solution,** 10 gram chloride and 1 ml. conc. HCl per 100 ml. water.

**Butyl mercaptan solution,** 0.5 normal, in cleaners' naphtha (free from RSH and free sulfur).

**Plumbite solution,** 125 gram sodium hydroxide in 1 liter water saturated with litharge and filtered.

**Isooctane,** technical.

**Alcohol,** ethyl, 95 per cent.

**Sulfuric acid,** 20 per cent.

**Acetic acid,** glacial.

**Zinc,** granulated (20 mesh).

**Mercury.**

**Mercurous nitrate,** pulverized $Hg(NO_3)\cdot H_2O$.

**Mercuric nitrate,** pulverized $Hg(NO_3)_2\cdot H_2O$.

# Natural Gas

## El Paso Natural to Increase Recovery of Residue Gas

WASHINGTON.—El Paso Natural Gas Co., El Paso, Tex., has received from Federal Power Commission authorization to install and operate facilities in Lea County, New Mexico, designed to increase recovery of wasted residue gas from 76,000,000 cu. ft. per day to 96,000,000. The facilities authorized include 31.5 miles of 16-in. natural gas pipe line beginning at the company's Eunice compressor station in Lea County and extending south to Jal Plant No. 1. Also the company is to construct and operate five 800-hp. gas-compressor units and two 175-kw. gas-engine-driven generators at the Eunice station; two 24-in. scrubbing towers of 13,000,000 cu. ft. daily capacity at the Eunice station, and two 24-in. scrubbing towers of 26,000,000 cu. ft. daily capacity at the Jal plant.

This will enable the company to deliver into its pipe lines 20,000,000 cu. ft. per day of hitherto wasted gas, thus conserving an equal volume of gas the company is daily withdrawing from its reserves. The company has been obtaining 76,000,000 cu. ft. daily of residue gas, including 34,000,000 ft. from Phillips Petroleum Co. The additional 20,000,000 ft. will be supplied by Warren Petroleum Co.

War Production Board has granted preference ratings for the materials required for the new facilities.

## Poe Argues for Repeal of Wisconsin's Tax on Gas

MADISON.—If Wisconsin fails to repeal laws passed in 1943 imposing a revenue tax of 7 cents per thousand cubic feet on natural gas sold within the state, Wisconsin "will be the only one to suffer," E. Holley Poe, formerly director of the natural gas and natural gasoline division of Petroleum Administration for War, told the judiciary committee of the Wisconsin assembly, which is studying the problem of this state's fuel supply.

The 7-cent tax hermetically seals Wisconsin against importation of natural gas, according to Poe, who named the railroads, coal interests, Federal Power Commission and some state commissions as "overburdened with grief about what they term 'the rapidly diminishing supply of natural gas in the nation.'" Men controlling federal bureaucratic regulation seek more power and wider jurisdiction, he declared, "sometimes even invading states rights."

The "ghost of early disappearing natural-gas reserves makes an attractive platform for such expansion of authority," said Poe.

Combating assertions that the nation's natural-gas reserves were in danger of depletion, Poe said these reserves were estimated in 1936 at 62 trillion cubic feet, in 1939 at 90 trillion, and in 1943 at 113 trillion, or 35 to 40 years' supply, equal to about 3¾ billion tons of coal. These estimates, Poe said, "do not indicate a rapidly diminishing supply of natural gas."

Characterizing the 7-cent natural-gas tax as discriminatory and not needed in view of the state's splendid financial condition, Poe asked, "If you apply that tax to natural gas, why not tax coal?"

The judiciary committee is not expected to take action till after April 12.

## I.N.G.A. Votes to Join in Natural-Gas Investigation

Following an all-day conference in Tulsa March 30, directors of Independent Natural Gas Association voted unanimously to participate in the natural-gas investigation before Federal Power Commission and authorized the executive committee to work out details. The committee is composed of E. Buddrus, Chicago; Joseph Bowes, Tulsa; Paul Kayser, El Paso; W. H. Wildes, Dallas; D. D. Harrington, Amarillo.

The executive committee was directed to employ legal and engineering staffs necessary for properly presenting the industry's case.

## Ohio Fuel to Get Panhandle Eastern's Excess Gas

WASHINGTON.—War Production Board's Office of War Utilities has directed Panhandle Eastern Pipe Line Co. to deliver to Ohio Fuel Gas Co. all available natural gas in its system in excess of customer requirements, beginning April 1 and continuing through October 31.

The purpose, Edward Falck, director of OWU, explained, is to build up during the summer months the underground storage supply of gas in Ohio to meet next winter's peak demands. The directive specifies that deliveries during the 7-month period shall be Panhandle's maximum daily surplus but not in excess of 9,000,000,000 cu. ft. for the entire period. This is estimated to be approximately one-fifth of the quanity that gas utilities in the Ohio-New York-Pennsylvania-West Virginia-Kentucky area will store underground during the summer.

# Natural Gasoline

## Anchor Petroleum Acquires Cimarron Gasoline Corp.

Anchor Petroleum Co. has purchased all the stock of Cimarron Gasoline Corp. Headquarters of both concerns are in Tulsa. Cimarron operates natural gasoline plants at Coyle and Guthrie, Okla. The daily capacity for production of natural gasoline and liquefied petroleum gas at the two plants is approximately 50,000 gal.

## Another High Attained in Natural-Gasoline Output

WASHINGTON. — Another new high in the daily average output of natural gasoline and allied products was attained in January, with a record of 13,011,000 gal. Texas Panhandle showed a gain of 22 per cent and California 11 per cent over their December figures, chiefly because condensate was included for the first time in the January statistics.

More detail of production and distribution of products from natural gas was available for January 1945 than formerly. The statistics show the balance of operations at natural-gasoline and cycle plants as indicated by plant and terminal reports.

**PRODUCTION**
(Thousands of gallons)

| | Jan. 1945 | Dec. 1944 |
|---|---|---|
| Natural gasoline | 177,932 | |
| Natural-gasoline mixture | 28,015 | 181,062 |
| Raw condensate | 42,513 | |
| Liquefied petroleum gases: | | |
| Comercial butane-propane mixture | 31,135 | |
| Normal butane | 39,464 | *100,338 |
| Propane | 21,878 | |
| Other mixtures (L.P.G.) | 11,734 | |
| Isobutane | 15,868 | *17,136 |
| Isopentane | 13,237 | |
| Finished gasoline and naphtha | 18,552 | |
| Other products | 3,014 | *79,338 |
| Total | 403,342 | *311,874 |

*Revised figures.

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# CONTINENTAL

SERVING THE OIL AND GAS INDUSTRIES

# REFINING

## DPC Approves Building of Toluene Plant at Borger

WASHINGTON.—Construction of a toluene plant near Borger, Tex., by Phillips Petroleum Co. has been authorized by Defense Plant Corp. The plant, costing approximately $6,600,000, is to be operated under lease by Phillips, with DPC holding title.

A contract has been awarded to Bechtel-McCone Co., Los Angeles, to build the plant, and work is expected to begin within a few days. Toluene produced will go to the Army as an ingredient of high explosives.

## More Products From Glen Davis Oil Shale Planned

WASHINGTON. — Importance of crude shale oil from the Glen Davis project in New South Wales, Australia, in the manufacture of petroleum products is revealed in a report prepared by the Department of Commerce. Production of crude shale oil in 1945 totaled 100,000 bbl., and the output of gasoline was about 25,000 bbl.

Plans have been made to expand Glen Davis' production facilities, and an output of about 250,000 bbl. of crude shale oil is predicted for 1945.

Glen Davis shale is generally considered the richest oil-bearing shale in the world and Australian authorities express confidence that its utilization will be of increasing importance in meeting the country's petroleum needs.

## Action Started for Swift Work on Toluene Plant

SHREVEPORT.—An order signed in federal court here gives the Government immediate possession of some 343 acres of land in Calcasieu Parish, where it is planned to start at once on construction of a war plant costing approximately $20,000,000, for production of toluene, an ingredient of TNT. Cities Service Oil Co. will operate the plant.

The suit for condemnation of the land was filed against Eleine Pujo Reyley et al, at the request of Reconstruction Finance Corp. by Defense Plant Corp. to provide facilities required for the project.

## Tests Developed for Evaluating Greases

BUFFALO. — Test methods for evaluation of greases designed for antifriction bearings have been developed by the joint committee of Annular Bearing Engineers and the National Lubricating Grease Institute. The committee has issued three bulletins describing these tests which are available to those interested in this field. Technical Bulletins Nos. 1, 4, and 5 are obtainable from C. W. Georgi, secretary of the Institute's technical committee, 164 Chandler Street, Buffalo 7, New York. Nos. 1 and 5 are available at $1 per copy, while No. 4 is priced at 50 cents per copy.

Among others items, Bulletin 1 describes a jointly developed test for low temperature properties of greases designed for service in aircraft operating at extremely high altitudes and temperatures as low as minus 60° F. This bulletin also describes the pressure-viscosimeter developed by Standard Development Co. to encourage further work on the measurement of grease viscosities. It recommends practices for determination of low temperatures, in which precise methods are mandatory.

Bulletin 4 describes the Norma-Hoffman bomb oxidation test. Bulletin 5 presents a new test apparatus and procedure for evaluating anti-

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## Asphalt Institute Chooses Its Officers for the Year

NEW YORK.—The Asphalt Institute, board of directors, representing most of the petroleum asphalt production industry of the United States and Canada, elected H. B. Pullar, of Berry Asphalt Co., chairman of the executive committee at its annual meeting here. The other members of the committee chosen are: Ole Berg, Jr., Union Oil Co. of California; C. E. Cox, The Carter Oil Co.; F. R. Field, Standard Oil Co. of New Jersey; A. M. Maxwell, Standard Oil Co. (Ohio); F. V. Widger, Witco Chemical Co.; J. S. Williams, Rock Island Refining Co.

The five vice presidents elected follow: Division 1, Atlantic-Gulf, F. R. Field; 2, Ohio-Great Lakes, A. M. Maxwell; 3, Midwest, C. E. Cox; 4, Southwest, J. S. Williams; 5, Pacific Coast, Ole Berg, Jr.

Bernard E. Gray was reelected general manager-chief engineer and Herbert Spencer president of the institute. George R. Christie, Socony-Vacuum Oil Co., Inc., was reelected secretary and treasurer, and John N. Smith of the same company was continued as assistant treasurer.

## Key to Fuel Supply Lies in Reserves, Says Plummer

AUSTIN.—Worry concerning gasoline for the future would be eliminated by development of potential oil reserves in the United States and Canada, according to F. B. Plummer, of the University of Texas bureau of economic geology.

"A detailed study of subsurface stratigraphy, development of cheaper coring methods and courage to test the favorable pinched-out sands at the most promising spots are what we need," said Plummer, urging the importance of more intensive subsurface engineering and geological work to open new fields.

Discussing foreign reserves, Plummer said: "Undoubtedly, many stratigraphic traps adjacent to the larger oceanic islands, the Philippines, the Netherlands Indies and the West Indies are filled with oil. Some of these chains of islands are simply ridges partly buried beneath overlapping sediments of the present seas. The subsurface strata contain rich source beds and probably oil pools exist along their borders.

Because oil shale is known to occur in quantity in 18 states and contains some 90 billion barrels of recoverable oil, Plummer believes that there are great possibilities for obtaining petroleum products from this shale.

## Licenses Obtainable From Alien Property Custodian

WASHINGTON. — Licenses under foreign patents in the hands of the alien property custodian may be obtained by United States citizens for $15 each, as an administrative fee, the custodian announced here. There are 45,000 of these patents, seized by the Government at the outbreak of the war late in 1941. Of this number 30,000 are of German origin, the remainder being divided between Italian and Japanese.

This list has been subdivided into 312 general groups, to facilitate examination, covering practically all industrial fields. To aid further persons studying the patents those dealing with the chemical field have been abstracted and the set of abstracts, 8,000 in number, may be obtained for $25 from the custodian's office in Chicago. Complete copies of all patents are to be seen at the custodian's offices at the Field Building, Chicago; 120 Broadway, New York; 17 Court Street, Boston; National Press Building, Washington, and the Guardian Building, Portland, Ore.

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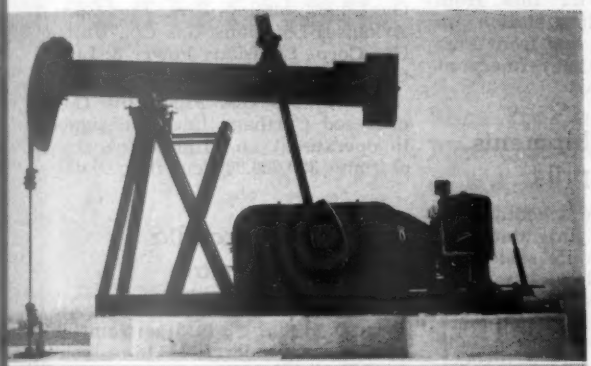

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**Double Reduction — Twin Crank**

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| Pumper Structure Capacity | 11,800 lbs. |
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| Overall Length | 15' 3¼" |
| Overall Width | 3' 4⅜" |

## 9DT45 — 45,250 Inch Pounds Torque

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| | |
|---|---|
| Pumper Structure Capacity | 8,700 lbs. |
| Crank Stroke | 18" - 24" - 30" - 36" |
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| Overall Length | 13' 7-5/16" |
| Overall Width | 3' 4⅜" |

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# PIPE LINES

## Utah Has WPB Permit for 150-Mile Rangely Line

Utah Oil & Refining Co. has recently received approval from War Production Board for construction of a crude-oil gathering system in the Rangely, Colorado, field and also for a 150-mile 10-in. line from Rangely to Wamsutter station on the company's main line from Fort Laramie, Wyo., to the refinery at Salt Lake City, Utah.

## Interstate Pipe Shipments Scheduled for April

Pipe shipments are scheduled to start this month for Interstate Oil Pipe Line Co.'s 120-mile system of 8-in., 10-in. and 12-in. for moving crude oil from Mississippi fields to Baton Rouge, La. Soon after the arrival of pipe, construction work will start. Bids from contractors were received early this week.

## Sinclair Contracts for Sand Draw, Wyo., Line

Sinclair Refining Co., pipe-line division, has awarded a contract to O. C. Whitaker Co. for laying 36½ miles of an 8-in. crude-oil line from Crooks Gap to Sand Draw, Wyo. The survey has been completed, pipe has been delivered and the contractor is now moving in preparing to start construction next week.

A large part of the 23-mile 8-in. line laid late in 1944 from Lost Soldier to Crooks Gap was laid on the surface of the ground temporarily. This is to be laid in the ditch.

## FPC Postpones United Hearings on Carthage Line

Federal Power Commission postponed until April 9 at Washington the hearing previously scheduled for March 26 on the application of United Gas Pipe Line Co. of Shreveport for authority to construct and operate additional facilities, including 142 miles of 24-in. pipe line in Texas and Louisiana. The line would run easterly from the Carthage field in East Texas to connect with facilities of United and Tennessee Gas & Transmission Co. in Ouachita Parish, Louisiana.

The United company proposes not only to supply 100,000,000 cu. ft. of gas per day to Tennessee Gas & Transmission Co. for use in the Appalachian area but contemplates increasing its own supplies to serve major customers now served by gas from the Monroe field in Louisiana. These customers include Memphis Natural Gas Co., Southern Natural Gas Co., Mississippi River Fuel Corp., Arkansas-Louisiana Gas Co., United Gas Corp., Louisiana Power & Light Co. and others.

The United Gas Pipe Line Co.'s proposed Carthage line is designed to operate at an ultimate capacity of some 300,000,000 cu. ft. per day.

## Sohio Lays Arcadia Outlet to Interstate

Sohio Pipe Line Co. has completed a 7½-mile 3-in. line from the Northeast Arcadia field to a connection with the Interstate Oil Pipe Line Co. trunk system in northeast-

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ern Oklahoma County.

Initial runs were made late last week. The field produced an average of 640 bbl. daily in February, has an allocation of 800 bbl. daily for April and May.

Prior to this time the oil has been trucked from the field to Luther where it was loaded into tank cars and shipped to the Imperial Oil, Ltd., refinery in Canada. Shortage of tank cars has prevented continuous operation of such system during the last few months.

Since last June, the Hoenig & Prince Tank Service hauled in excess of 123,000 bbl. of crude from the field to the Luther loading rack. At times the company was running trucks over the route on a 24-hour daily schedule in order to expedite the movement on tank cars.

## Penn-York and Republic Plan Operation Changes

Federal Power Commission held a public hearing on March 31, 1945, in the U. S. Court House, Buffalo, N. Y., on the joint amended application filed by Penn-York Natural Gas Corp. and Republic Light, Heat & Power Co. for (1) authority on the part of Penn-York to abandon certain pipe-line and compressor facilities and (2) for a certificate of public convenience and necessity on the part of Republic to construct and operate additional pipe-line and compressor facilities including the facilities to be abandoned by Penn-York. These facilities are located in Chautauqua and Erie counties, New York.

## Pipe Lines Adequate for Sour Gas Deliveries

Completion of a new pipe line for natural gas in the Panhandle of Texas will assure an ample supply of sour gas for new plants manufacturing carbon black, according to a recent statement of Chairman Olin Culberson of the Railroad Commission.

He gave this assurance to a group of War Production Board officials, who were interested in securing the raw material for the new production. Culberson told the WPB officials that he had been assured the new Phillips Petroleum Co. pipe lines from Rock Creek to the east end of the Panhandle field where the plants are located is in the process of completion.

WPB has made several efforts to obtain the use of sweet gas for carbon black production, but this is prohibited by statute in Texas.

Culberson said he believed the WPB representatives were satisfied at the results of the conference.

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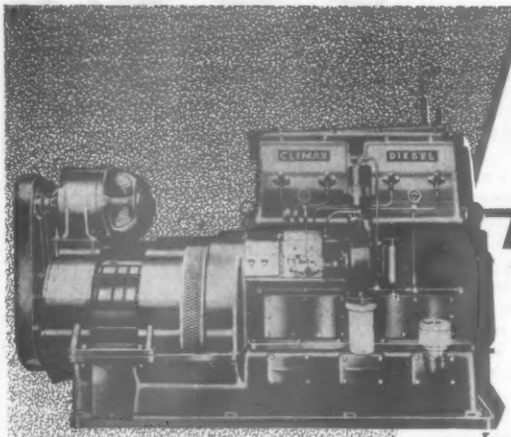


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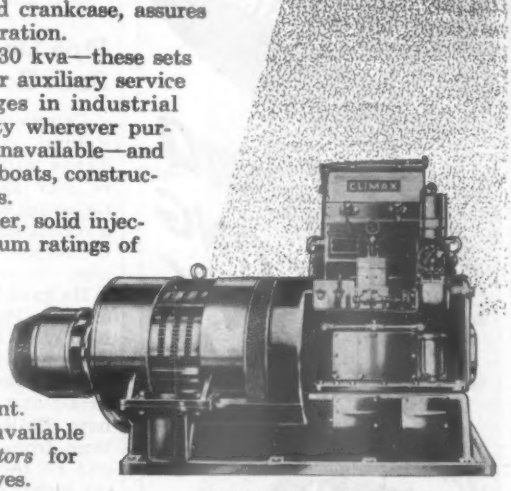
Engines are also available *without generators* for mechanical drives.

For complete information and specification bulletin, write Climax Engineering Company, Clinton, Iowa.

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# Exploration and Drilling

## Week's Highlights

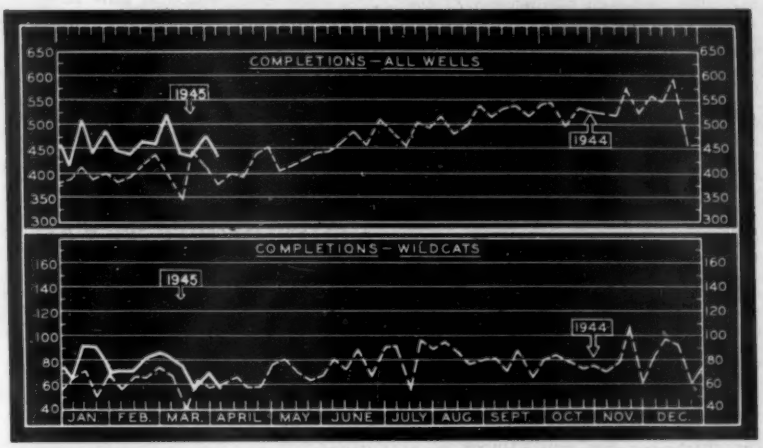
THERE is a minor but noticeable hesitancy in the general exploratory play. The play is still strong, but for the moment at least, there is uncertainty about prospective wildcat deals. This is not yet indicative of any particular trend, but it might develop into one. The reason no trend is perceptible is that a variety of factors are involved, with no one dominant.

For example, there is some evidence of a desire on the part of geologists and geophysicists to take a little more time for interpretation of data on various prospects, before recommending a location for a test. This is not unnatural, for with manpower spread thin in both groups, the strain of handling record breaking numbers of wildcats is beginning to be felt. Moreover, the keynote of the geologists' meeting in Tulsa last week was a call for more use of controlled imagination in interpreting available data. At the regional meeting of the geophysicists held this week, the stress again was on interpretation of existing data.

In both cases this amounts to a plea for more time to spend in examining and interpreting data. This plea is based on the fact that the major investments, both in money and man-hours, have been devoted to gathering data.

Then there is the pinch of cutting back material allotments for second quarter drilling. It has been said that possibly the PAW drilling quota could be met by drawing on inventories. The trouble is that expanded operations call for a larger inventory, rather than a smaller one. After whittling down inventories in 1942 and 1943, and then expanding drilling operations in 1944 and 1945, for many companies there just isn't any inventory to draw upon to meet enlarged second quarter drilling.

The recent court ruling disallowing deductions of intangible drilling costs as expense items, is having some effect on operators. The large companies have deferred many drilling operations but seem confident of congressional relief. Smaller operators, however, do not have the capital resources to risk the long term outlook that this entails and have suspended all possible drilling.




*Solid line charts current weekly completions, service wells in Eastern area included*

### COMPLETIONS IN ALL FIELDS . . .

**Week ended March 31, 1945**

| | Oil | Gas | Dry | Total | Footage | Total Comp. to date 1945 | 1944 |
|---|---|---|---|---|---|---|---|
| New York | 16 | 0 | *14 | 30 | 42,060 | 270 | 236 |
| Pennsylvania | 31 | 6 | †28 | 65 | 99,314 | 854 | 474 |
| West Virginia | 1 | 10 | *1 | 12 | 31,569 | 184 | 118 |
| Ohio | 3 | 5 | 5 | 13 | 40,068 | 176 | 228 |
| Indiana | 0 | 0 | 1 | 1 | 1,414 | 41 | 58 |
| Kentucky | 0 | 3 | 0 | 3 | 6,555 | 87 | 138 |
| Illinois | 11 | 0 | 11 | 22 | 56,250 | 392 | 403 |
| Michigan | 5 | 0 | 7 | 12 | 35,759 | 178 | 129 |
| Kansas | 6 | 1 | 15 | 22 | 77,488 | 360 | 438 |
| Nebraska, Missouri, Iowa | 0 | 0 | 0 | 0 | 0 | 11 | 12 |
| Oklahoma | 20 | 3 | 15 | 38 | 181,666 | 560 | 359 |
| Texas | 86 | 11 | 37 | 134 | 575,153 | 1,704 | 1,150 |
| North Central | 23 | 0 | ‡16 | 39 | 88,927 | 473 | 316 |
| West | 32 | 1 | 6 | 39 | 167,460 | 457 | 346 |
| Panhandle | 4 | 6 | 0 | 10 | 31,355 | 135 | 34 |
| Eastern | 1 | 0 | 1 | 2 | 15,837 | 73 | 82 |
| Gulf Coast | 15 | 3 | 10 | 28 | 192,108 | 406 | 154 |
| Southwest | 11 | 1 | 4 | 16 | 79,466 | 160 | 218 |
| Louisiana | 6 | 3 | 6 | 15 | 101,951 | 223 | 159 |
| Northern | 2 | 3 | 3 | 8 | 41,357 | 71 | 61 |
| Southern | 4 | 0 | 3 | 7 | 60,594 | 152 | 98 |
| Arkansas | 4 | 0 | 3 | 7 | 38,581 | 35 | 53 |
| Mississippi | 3 | 0 | 0 | 3 | 16,417 | 75 | 30 |
| Southeastern States | 0 | 0 | 0 | 0 | 0 | 7 | 7 |
| Montana | 2 | 0 | 1 | 3 | 14,350 | 66 | 53 |
| Wyoming | 2 | 0 | 0 | 2 | 8,305 | 49 | 35 |
| Colorado-Utah | 0 | 0 | 0 | 0 | 0 | 7 | 10 |
| New Mexico | 5 | 1 | 3 | 9 | 37,214 | 123 | 101 |
| California | 35 | 1 | 5 | 41 | 144,320 | 573 | 450 |
| Total United States | 236 | 44 | 152 | 432 | 1,508,434 | 5,975 | 4,641 |
| Total previous week | 270 | 37 | 170 | 477 | | | |
| Total April 1, 1944 | 213 | 32 | 96 | 341 | | | |

Service wells included: *14, †27, ‡1.

# TEXAS GULF COAST

## Discovery Well for Blue Lake Field Is Completed

HOUSTON.—Glenn H. McCarthy et al 1 Ida Dudley Wilson et al, discovery well of the Blue Lake field of Brazoria County, in John Bradley Survey, about 5½ miles northwest of Angelton, is completed pumping 60.78 bbl. daily of 34.8° gravity oil with about 10 per cent water, from 39 perforations at 8,702-14 ft. Total depth is 10,808 ft. with 7-in. liner set at 6,522-8,868 ft.

General Crude Oil Co. 3 Security Bank & Trust Co., west extension to Lake City pool, Wharton County, flowed a potential of 130 bbl. daily on ½-in. choke, with gas-oil ratio 1,677, tubing pressure 900 lb., casing pressure 1,325 lb., gravity 25.9°, no water. Total depth is 5,438 ft. with 5½-in. casing set on bottom. This is the second producer for the pool and is in the S. Castleman Survey 5, 1,000 ft. west of the discovery well.

The Alief pool of Harris County has been extended, and a new producing sand opened, in Cities Service Oil Co. 1 F. R. Lummis, George Bellows Survey. Drilled out total depth is 8,328 ft. and pipe was perforated with 45 shots at 8,315-26 ft., with packer set at 8,285 ft. On a 7-hour test, using ⅜-in. choke, the well flowed at the rate of 110.8 bbl. of 51.8° gravity condensate per day with 5,110,000 cu. ft. of gas, tubing pressure 1,798 lb., about 5 per cent water in the flow. Operators are preparing to run potential. Other wells in the field produce from a sand about 7,900 ft.

Humble Oil & Refining Co. completed 6 M. L. Kirby, George W. Brooks Survey, Silsbee pool of Hardin County, for a potential of 115.12 bbl. of 42.° gravity oil daily through ⅛-in. choke with 2,050 lb. pressure on tubing and 2,200 lb. pressure on casing. Gas-oil ratio is 5,420. Drilled to 8,129 ft., the test was plugged back to 7,465 ft. for completion through 18 perforations at 7,452-55 ft.

**SUCCESSFUL WILDCAT COMPLETION IN GULF COAST TEXAS**

Brazoria County: Blue Lake field discovery—Glenn H. McCarthy et al 1 Ida Dudley Wilson et al, John Bradley Sur., 5.7 mi. NW Angelton, TD 10,808 ft., perf. 8,702-14 ft., PT 60.78 bbl. daily on pump, gas-oil ratio 100, gravity 34.8°, 10 per cent water.

**WILDCAT FAILURES COMPLETED IN GULF COAST TEXAS**

Austin County: Chas. Snellstrom 1 Ed Blazek, David Milburn and Thomas Davis Sur., junked at 2,376 ft.

Liberty County: Jack W. Frazier 1 Ada Ola Willis, Robert Burrell Sur., 3 mi. E Devers, dry at 8,005 ft.

Matagorda County: A. H. and C. L. Rowan 1 Louis LeTulle, Richard Graves Sur., 2½ mi. W Markham, dry at 10,347 ft.

Orange County: Pan American Production and Tide Water 1 Miller-Vidor Land Co., John Peveto Sur., 3 mi. W Orange, dry at 8,013 ft.

# SOUTHWEST TEXAS

## New Producing Area South of Ben Bolt Field

CORPUS CHRISTI.—Bridwell Oil Co. 1 Ramon Garcia, wildcat, 3½ miles southwest of Ben Bolt townsite, Jim Wells County, in the Trinidad grant, opens a new producing area 1 mile south of Ben Bolt field. On 24-hour potential test, the well flowed 156 bbl. through ¼-in. choke, tubing pressure 100 lb., casing pressure 600 lb., gravity 36°, gas-oil ratio 346, from 36 perforations at 4,376-82 ft. Total depth is 4,440 ft. with 5½-in. casing set on bottom.

Humble Oil & Refining Co. 1 D. J. Sullivan, Account 1, discovery well for Mariposa field, in Brooks County, 8 miles southeast of Falfurrias, ran an 18-hour test of perforations at 7,740-50 ft. The well flowed at the rate of 3,666,000 cu. ft. of gas per day through ¼-in. choke, casing pressure 2,550 lb., separator pressure 550 lb., and 108.56 bbl. per day of amber-colored condensate. Operators are preparing to run open flow test. On previous test of the lower sand, the well flowed 297 bbl. per day, ⅛-in. choke, from perforations at 8,537-43 ft.

W. H. Holland discovered a new producing sand for the Boyle field area in Starr County, in his 1 Sugarland Industries, located in Tract "E", Share 7-B, Porcion 92, about ½ mile east of the Boyle field production. The well was completed in sand at 4,031-43 ft., flowing 200 bbl. daily, through 3/16-in. choke, tubing pressure 420 lb., casing pressure 950 lb. Total depth of the hole is 4,194 ft.

Southern Minerals Corp. 1 Martinez Mercantile Co., Falls City field, Karnes County, made drill-stem test at 4,623-37½ ft., 30 minutes, using ¼-in. chokes, 5 lb. working pressure, recovered 1,010 ft. of pipe-line oil. This is the upper sand which showed water in the discovery well, and which is 7-ft. higher in this well. The discovery sand was cored at 4,655-60 ft., ran drill-stem test but no details were released on the test. The Carrizo sand carried an odor. Recovered little oily mud on drill-stem test in this sand.

The South Texas Geological Society has announced the name "West Goliad" for the field discovered by Sun Oil Co. 1 R. A. Thompson, Ignacio Guarajardo Survey, Goliad County.

**SUCCESSFUL WILDCAT COMPLETIONS IN SOUTHWEST TEXAS**

Brooks County: Mariposa field discovery—Humble 1 D. Sullivan, Acct. 1, M. D. Floyd Sur. 152, 8 mi. SE of Falfurrias, TD 8,545 ft., perf. 7,740-50 ft., tested for gas volume and shut in, perf. 8,537½-45½ ft., PT 293.90 bbl. condensate a day through ½-in. choke, gas-oil ratio 998, tubing pressure 1,500 lb., gravity 40.7°, no water.

Live Oak County: Kittie West field discovery — Continental 1 Kittie West Schreiner, D. R. Fant and J. Poitevent Sur., 5 mi. S of Kittie, TD 7,614 ft., perf. 6,705-11 ft., PT 46 bbl. daily through ¼-in. choke, gas-oil ratio 63,950, estimated 7,500,000 cu. ft. gas, open flow, tubing pressure 2,070 lb., gravity 55.2°, 15.6 per cent basic sediment and water.

**WILDCAT FAILURES COMPLETED IN SOUTHWEST TEXAS**

San Patricio County: Hewit & Dougherty 1 Walter F. Timon, San Patricio de Hibernia grant, 10 mi. SE Mathis, dry at 6,250 ft.

H. H. Howell 1 Paul A. Allen, Mathis Ranch subd., 3 mi. SW Mathis, dry at 5,215 ft.

Zapata County: Humble 1 Paula V. de Garza, GS&F Sur., 9 mi. SW Randado, dry at 6,255 ft.

## DAILY AVERAGE PRODUCTION FOR WEEK

| | Mar. 31 crude oil | Distillate, allied products | April PAW quota all oils | Mar. 24 crude oil |
|---|---|---|---|---|
| Alabama | 250 | ..... | 300 | 250 |
| Arkansas | 80,600 | 5,200 | 85,200 | 80,200 |
| California | 903,750 | 58,560 | 977,380 | 907,500 |
| Colorado | 10,250 | ..... | 10,500 | 10,450 |
| Eastern | 63,900 | 8,400 | 76,600 | 66,800 |
| Illinois | 187,900 | 12,000 | 217,000 | 191,600 |
| Indiana | 10,200 | ..... | 12,500 | 10,700 |
| Kansas | 275,850 | 4,300 | 278,300 | 275,500 |
| Kentucky | 17,100 | 3,200 | 35,200 | 14,600 |
| Louisiana | 366,100 | 40,000 | 400,000 | 365,750 |
| North Louisiana | 70,500 | ..... | ..... | 70,100 |
| South Louisiana | 295,600 | ..... | ..... | 295,650 |
| Michigan | 47,000 | 700 | 47,700 | 51,050 |
| Mississippi | 52,300 | ..... | 53,000 | 52,200 |
| Montana | 22,850 | 300 | 23,300 | 23,300 |
| Nebraska | 1,000 | ..... | 1,000 | 950 |
| New Mexico | 103,550 | 4,900 | 109,000 | 103,600 |
| Oklahoma | 372,950 | 28,000 | 395,500 | 369,350 |
| Texas | 2,159,000 | 160,000 | 2,330,000 | 2,159,000 |
| East Texas | 381,000 | ..... | ..... | 381,000 |
| East Central Texas | 146,700 | ..... | ..... | 146,700 |
| North Central Texas | 149,300 | ..... | ..... | 149,300 |
| Texas Panhandle | 88,000 | ..... | ..... | 88,000 |
| West Texas | 477,400 | ..... | ..... | 477,400 |
| Southwest Texas | 352,150 | ..... | ..... | 352,150 |
| Texas Gulf Coast | 564,450 | ..... | ..... | 564,450 |
| Wyoming | 102,350 | 3,600 | 103,600 | 99,500 |
| Total United States | 4,776,900 | 329,160 | 5,156,960 | 4,782,300 |
| Change from previous week | down 5,400 | | | |

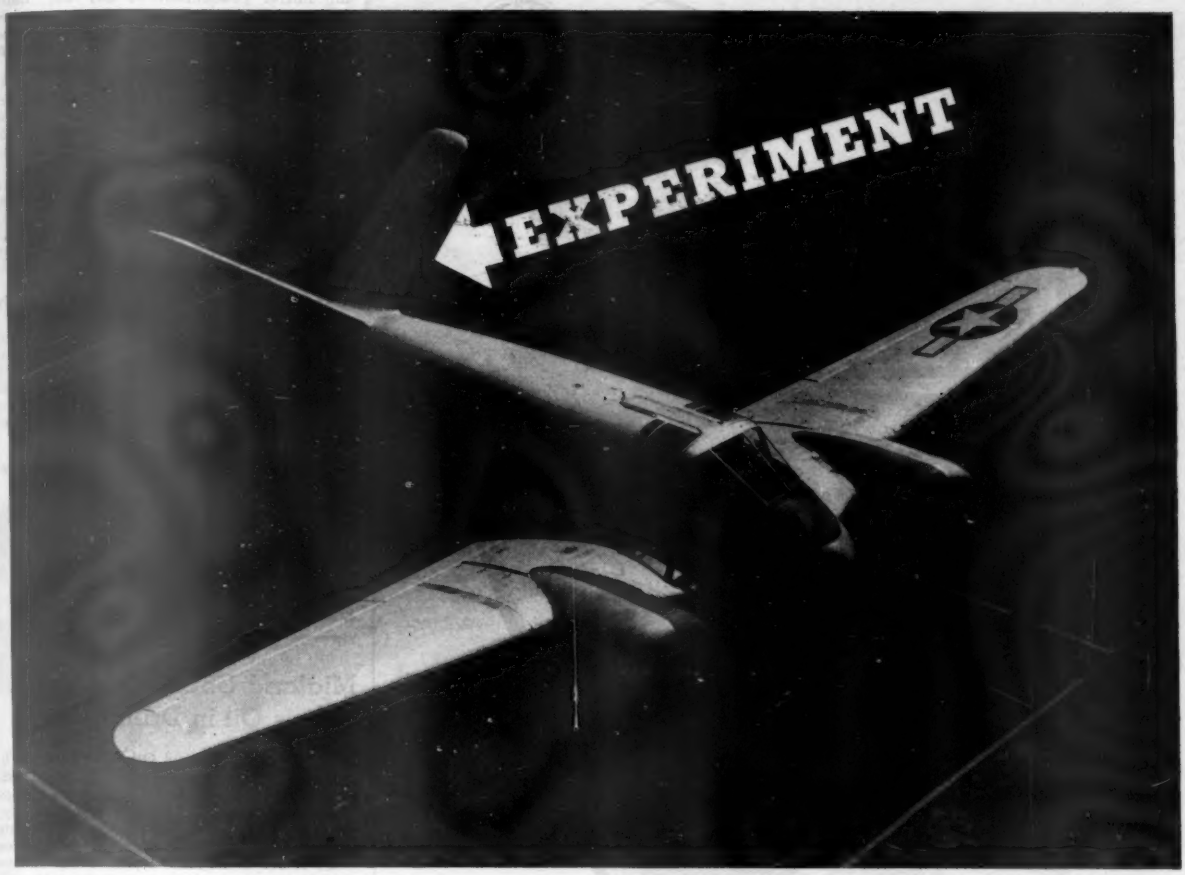
Total production January 1-March 31, 1945 ..... 427,238,750 bbl.
Same period last year ..... 399,792,151 bbl.

# SOUTH LOUISIANA

## Napoleonville Dome Extended to Northwest

NEW ORLEANS.—Production is opened on the northwest flank of Napoleonville dome in Assumption Parish by The Shell Oil Co., Inc. 1-A Dugas-LeBlance, Section 40-12s-13e, which flowed a potential of 212 bbl. daily through ½-in. choke, tubing pressure 1,205 lb., gravity 39.7°, gas-oil ratio 755, from 20 perforations at 6,868-6,893 ft. Oil sand was reported at 6,858-93 ft., and the well had another sand showing oil at 6,812-40 ft. This new production is 3½ miles west of the east flank production on the opposite side of the dome. Total depth is 7,405 ft.

Humble Oil & Refining Co. completed the 2 Sarpy Brothers, Section 7-12s-8e, at Good Hope field, St. Charles Parish, for



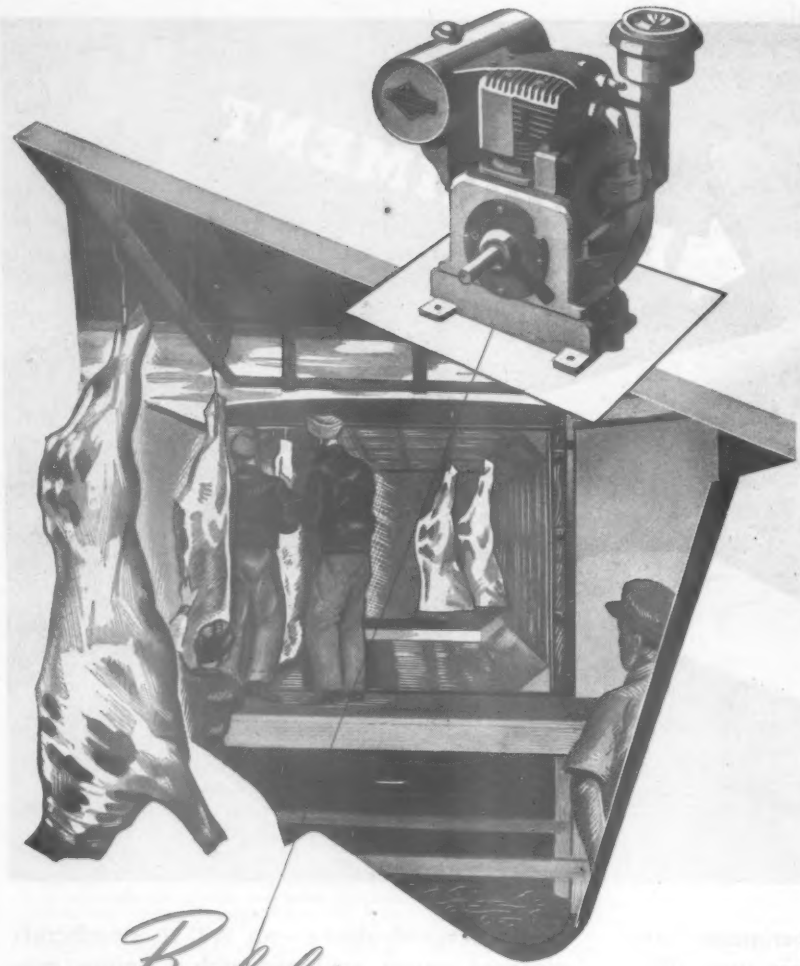

MANY research projects and experiments have been originated by Beech engineers since 1932. The results of their willingness to explore new fields are notable. The unique negative stagger Beechcraft biplane, long outstanding in its power class, is one. Another is the Model 18 all-metal twin-engine Beechcraft feeder airline and executive transport, an airplane which since 1936 has made such a record that thousands of these planes serve the armed forces as advanced trainers and personnel transports all over the world.

Since 1941, research at Beech Aircraft has had as its purpose the creation of improvements in aircraft designed for military use., Most of this research cannot be described, for obvious reasons. Something can be told, however, about the experiment pictured above—an AT-10 Beechcraft advanced trainer equipped with a unique two-element empennage which replaces the conventional tail group. Its successful flight tests have shown interesting possibilities.

Whether or not this particular experiment proves practically useful is unimportant. What does matter is the spirit behind such research—an aggressive exploratory spirit that is not confined by tradition and convention but is free to operate anywhere within the boundary of sound engineering principles. The Beechcrafts of the future undoubtedly will reflect the gains attained through such a program, and will offer to their owners, whether military or commercial, an extra degree of performance and value.

Beech Aircraft CORPORATION

BEECHCRAFTS ARE DOING THEIR PART WICHITA, KANSAS, U.S.A.



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an initial production of 281 bbl. daily through 5/32-in. choke, tubing pressure 1,375 lb., gravity 36.6°, 2-in. tubing set at 7,710 ft. Total depth is 8,833 ft. with 7-in. casing set to 7,920 ft.

Barnsdall Oil Co. 3 Minos Miller, 31-7s-2w, at West Tepetate field in Jefferson Davis Parish, showed for production in a new sand for the field from perforations at 8,400-08 ft. Drill-stem test at this level showed a flow of 600 bbl. daily through ¼-in. choke with 614,000 cu. ft. gas per day. Operators are still testing. Total depth is 8,572 ft. with 7-in. casing set on bottom. Should the well be completed here it will open the field's fourth productive zone.

**SUCCESSFUL WILDCAT COMPLETION IN SOUTH LOUISIANA**

Plaquemines Parish: Potash field, new sand — Humble 1-B Orleans Levee Board, 14-18s-15e, TD 10,910 ft., perf. 10,869-79 ft., PT 267.78 bbl. day through 9/64-in. choke, gas-oil ratio 510, tubing pressure 1,775 lb., gravity 31.7°, water 10 per cent.

**WILDCAT FAILURE COMPLETED IN SOUTH LOUISIANA**

Cameron Parish: Continental 2 State-Calcasieu Lake, Sec. 1-14s-9w, dry at 9,874 ft in sidetracked hole.

## PERMIAN BASIN

### Midland County Wildcat Shows Oil in Drilling Mud

MIDLAND.—Humble Oil & Refining Co. Mrs. O. P. Buchanan, Section 32, W. M. Baldridge Survey, wildcat 9 miles southeast of Midland, Midland County, showed some oil and gas in mud returns while drilling from 10,347-75 ft. Cores from 10,347-62 ft. and 10,362-75 ft. recovered 11 ft. of lime and shale but no shows. On an intended 60-minute drill-stem test at 10,375 ft., the valve failed after 1 minute. However, 2,900 ft. of gas-cut water and 5,700 ft. of gas-cut drilling mud were recovered. Another core will be taken and drill-stem test will be made.

Sun Oil Co. 1 Mrs. J. B. Roberdeau is drilling ahead after a 60-minute drill-stem test from 6,322-65 ft. recovered 10 ft. of drilling mud but no shows. Ellenburger was topped at 6,338 ft.

Woodley Petroleum Co. 1 Ellwood estate, west outpost to the Smyer pool in eastern Hockley County, will be plugged back to 5,960 ft., believed to be bottom of pay, from 6,028 ft., where it had 700 ft. of water and 1,700 ft. of oil in the hole.

**Andrews County.** — Shell Oil Co., Inc. and The Texas Co. 1 Ratliff & Bedford, assured Devonian producer in southwestern Andrews, aabout 9 miles west of the West Andrews pool, made a 64-minute drill-stem test from 9,111-60 ft., using ⅝-in. bottom-hole choke. It had gas to the surface in 3 minutes and gaged 1,400,000 cu. ft. of gas at the end of 5 minutes, with oil to the surface in 16 minutes. The well flowed 28 bbl. of oil into the pits the last 37 minutes of the test. It is drilling ahead below 9,160 ft. in lime and chert. Stanolind Oil & Gas Co. 1-P University, Devonian pool opener for central Andrews, 3 miles south of the Fullerton area, flowed 220 bbl. of 40-gravity oil through perforations from 8,750-70 ft. Gas-oil ratio was 1,200 to 1. Total depth is 8,852 ft.

Magnolia Petroleum Corp. 1-A Ralph, wildcat 1 mile west of the northwest side of the Fullerton pool, Andrews County, set a double packer at 10,733-35 ft. and is preparing to take a drill-stem test. Total depth is 10,990 ft.

Shell 1 Pierson, 1¼ miles east and slightly south of the nearest Clear Fork lime producer in the Russell pool in

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Type "E" Tubing Catcher with Anchor

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northwestern Gaines, swabbed 151 bbl. of oil in 24 hours at 7,727 ft., the total depth. The well was shut in to move off rotary for completion. Humble will drill a 5,500-ft. wildcat in northeastern Gaines. It is 1 O. L. Biship and is 1,980 ft. from the south and west lines of Section 25, Block H, D&W Survey, 6 miles southwest of the Cedar Lake pool.

**WILDCAT FAILURES COMPLETED IN WEST TEXAS**

Fisher County: Thomas W. Doswell 1 J. S. Humphries, Sec. 49, Blk. 1, HT&B Sur., 1½ mi. S McCauley pool, elev. 1,918 ft., Noodle Creek 2,989 ft., dry, TD 3,311 ft.

Pecos County: G. F. Aldrich 1 Shell-Johnson, Sec. 36, Blk. 140, T&St.L., 1¾ mi. SW Fromme pool, elev. 2,475 ft., dry, TD 1,822 ft.

Bryce McCandless 1-115 Atlantic, Sec. 115, Blk. 11, H&GN Sur., ½ mi. W Owego, elev. 2,414 ft., dry, TD 1,643 ft.

Yoakum County: Honolulu Oil 1 F. G. Hanna, Sec. 80, Blk. D, John H. Gibson Sur., 4 mi. SW Slaughter pool, elev. 3,640 ft., dry, TD 5,213 ft.

Texas Gulf Prod. Co. 1 Powell, Sec. 4, Blk. D, J. H. Gibson Sur., 1½ mi. NE Ownby pool, dry, TD 5,532 ft.

**SUCCESSFUL WILDCAT COMPLETION IN WEST TEXAS**

Hockley County: Extension to old oil pool—Stanolind 1 Yellowhouse, Labor 2, League 718, State Capitol Lands Sur., 2 mi. NE 1 Tom Cobb, Yellowhouse pool discovery, elev. 3,484 ft., plugged back to 4,582 ft., top pay 4,549 ft., San Andres 3,535 ft., pumped 62 bbl. day through 2-in. tubing, perf. 4,560-82 ft., gravity 30°, TD 4,609 ft.

**SOUTHEASTERN NEW MEXICO**

HOBBS.—Samedan Oil Co. 1 O. I. Boyd, 23-22s-37e, wildcat 1¾ miles northwest of the Drinkard pool in southeastern Lea County, on a 60-minute drill-stem test in the Holt zone from 5,082-5,183 ft. showed gas in 12 minutes, which was exhausted before tool was closed, and recovered 540 ft. of gas-cut mud and 90 ft. of slightly oil-cut and gas-cut mud. It was drilling below 5,220 ft. in lime.

Three miles southwest, Gulf Oil Corp. 1 E. T. Paddock, which flowed 16 bbl. of oil per hour from the Holt zone from 5,150-5,288 ft., was drilling below 5,820 ft. in lime, seeking production in the Lower Permian.

Gulf 1 State-Andrews, 1½ miles southeast of the Drinkard discovery, is reported flowing at the rate of 8 bbl. of oil per hour through perforations from 6,950-7,000 ft. while testing. One-half mile north of 1 State-Andrews, Gulf 1 Higgins is drilling below 2,530 ft. in anhydrite.

**WILDCAT FAILURE COMPLETED IN SOUTHEASTERN NEW WEXICO**

Lea County: Neville G. Penrose 2 Hinton, 12-22s-37e, elev. 3,350 ft., 1 mi. N Penrose deep pool, Yates 2,550 ft., dry, TD 4,700 ft.

**PANHANDLE**

AMARILLO.—Humble Oil & Refining Co. 1 J. W. Hyslop, wildcat 35 miles from Hereford in southwest Deaf Smith County, with total depth of 7,805 ft. in granite, was plugged back to 6,658 ft. Seven-inch casing was set at 6,744 ft. Operator is bailing hole to test for casing leaks preparatory to perforating casing between 6,565-95 ft.

**SUCCESSFUL WILDCAT COMPLETION IN THE PANHANDLE**

Hartley County: New gas pool—Phillips 1 P. M. Ames, Sec. 47, Blk. 44, H&TC Sur., 9 mi. NE Channing, elev. 3,790 ft., IP 43,500,000 cu. ft gas per day, TD 3,620 ft.

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# MICHIGAN

## Mecosta and Wheatland Areas Show Possibilities

SAGINAW.—Interest centers this week on Mecosta County and the possibility of a new pool in Wheatland Township, about 8 miles west of the Sherman-Isabella pool. The Smith Petroleum Co. test in the Dundee at 3,686 ft. filled with 1,200 ft. of oil when it was shut down to run casing. Three dry holes previously had been drilled within 2 miles of the Smith venture, which is in Section 7.

Isabella County's unusually successful Coldwater field added its twenty-fourth successive producer without a dry hole last week at Sohio Petroleum Co. 2 Dague which flowed 325 bbl. in 13 hours. It is on the west side of the pool on which wells are spaced on a 40-acre pattern.

Michigan operations resulted in a total of 12 completions, Chippewa field furnished another good producer, Rex Oil & Gas Co. 1 Gaudreau & Byron in Section 12, being estimated at 2,100 bbl. daily. Five of the seven dry holes were wildcat tests, including another Sun Oil Co. exploratory hole to below the 1-mile level in Roscommon County.

Three of the 12 new drilling permits issued by the state conservation department are for Allegan County locations, two for Osceola, one each for Bay, Clare, Midland, Missoukee, Gratiot, Isabella and Van Buren.

**MICHIGAN WILDCAT FAILURES**

Allegan County, Monterey Township: Rex Oil & Gas Co. 1 Elmer Curtis, NE NE NE 15-3n-13w, dry in Traverse limestone, TD 1,849 ft.

J. W. Lang Co. 1 Mary Lay, NE SW

SW Sec. 25, dry in Traverse limestone, TD 1,698 ft.

Gratiot County, North Shade Township: Fisher-McCall Oil & Gas Co., Inc. 1 Kenneth Wright, SW SW SW 36-9n-4w, dry in Traverse limestone, TD 2,689 ft.

Oceana County, Otto Township: Sinclair-Wyoming Oil Co. 1 Lena C. Newman, SE SE NE 7-13n-16w, dry in Monroe, TD 3,500 ft.

Roscommon County, Roscommon Township: Sun Oil Co. 1-B State-Roscommon, C N½ NW NW 24-21n-4w, dry, TD 5,402 ft.

# ILLINOIS

## Nine Wildcats Start in Five Central Basin Counties

CENTRALIA.—Field development in Illinois is still retarded by mud and bad roads, and last week only 22 wells were completed in the state, 11 oil wells and 11 dry holes. One wildcat completion in Wayne County proved to be a small initial producer, an outpost to the Clay City field. Seven of the dry holes were wildcats in Franklin, Madison, McDonough, Marion, Richland, Wabash and Washington counties.

The Texas Co. is drilling a Devonian lime test in the Woodlawn field in Jefferson County, 1 Eubanks, SW SW SE 35-2s-1e. The pool produces from Benoist and Aux Vases sands. Another interesting test in Jefferson County will be J. V. Canterbury 1 Riley Ross, SE SE SE 7-3s-4e, for which location has been made.

Eight of the 11 completed producers averaged 47 bbl. per well. Three others averaged 341 bbl. per well. The best new well of the week was Pure Oil Co. 1 E. R. Dwyer, NE NE NE 12-1n-7e, in the Clay City field in Wayne County, which flowed 545 bbl. per day from Rosiclare lime at 3,011-20 ft., total depth 3,025 ft. It had not been acidized.

Twenty-two new operations kept pace with the completions, but of interest was the fact that nine of the new operations are wildcats as follows: Ashland Oil & Refining Co. 1 E. E. McLinn, NE SE SW 33-1s-8e; Ashland 1 Jerome Molt, NW NW SE 30-1n-8e, and Nash Redwine 1 B. H. Crews, SE SE SE 6-2s-9e, all in Wayne County; John T. Peck 1 C. C. Rowley, NE SE NW 29-7s-5e, Saline County; Magnolia Petroleum Co. 1 E. and S. F. Robinson, 330 ft. rfom west and 400 ft. from north lines 10-2n-4e, Marion County; A. K. Swan et al 1 Fuller, SW NE NW 13-2s-1e, Jefferson County; Ryan Oil 1 Ibbotson, NW NE NW 17-1n-10e, H. C. Hageman 1 Koenecke, NW NE NW 20-1n-10e, and Perry Fulk et al 1 G. F. Vaughn, SW NW SE 12-1n-10e, all in Edwards County.

### SUCCESSFUL WILDCAT COMPLETION IN ILLINOIS

Wayne County: Pure 1 L. K. Secrest, NE NE NW 21-1n-8e, McClosky lime at 3,083-86 ft. and 3,128-32 ft., acidized with 5,000 gal., pumped 34 bbl. oil in 24 hours, TD 3,141 ft.

### WILDCAT FAILURES IN ILLINOIS

Franklin County: Schuller & Witt 1 H. B. Stalcup et al, NE NE SW 18-5s-3e, dry at 3,104 ft. Tar Springs sand 2,132 ft., Cypress 2,491 ft., Benoist 2,672 ft., Aux Vases 2,745 ft.

Madison County: Joe Kesl, Jr. 2 H. M. Whiteman, SE SW SE 24-5n-6w, dry at 1,994 ft. No log.

McDonough County: A. M. Scroggins 1 Mason, NW SW NW 19-5n-3w of 4th p.m., dry at 560 ft. Kincaid top 340 ft.

Marion County: Magnolia 1 T. A. Neal, SE SE SE 33-4n-4e, dry at 2,536 ft. Menard 1,735 ft., Cypress 2,136 ft., Benoist top 2,274 ft., Benoist sand 2,281


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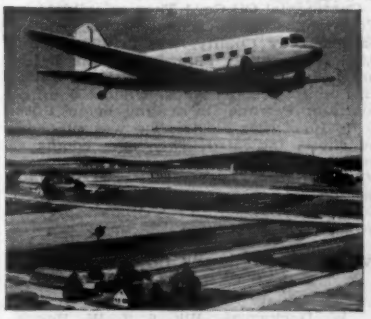
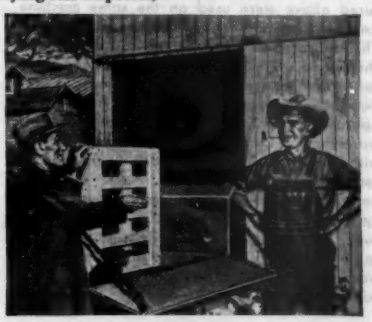


**DEALER ABSORBS** Air Express charges but, even so, he figures a saving of money — because the pump is a high-priced, slow-turn unit that he cannot afford to stock. (With Air Express the nation's inventory is within hours of your business.)



**THOUSANDS** of businessmen find this fastest delivery a real economy — *a real money-maker* — when a customer wants something not in stock. (Yes, with Air Express, you give high-speed service on high-priced items without cost of stocking.)

## Specify Air Express — Low Cost for High Speed

25 lbs., for instance, travels more than 500 miles for $4.38, more than 1,000 miles for $8.75, more than 2,000 miles for $17.50, at a speed of three miles a minute — with cost including special pick-up and delivery in all U. S. cities and principal towns. Same-day delivery between many airport towns and cities. Direct service to scores of foreign countries. Rapid air-rail service to 23,000 off-airline points in the United States.

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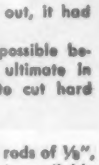


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ft., Aux Vases 2,329 ft., Ste. Genevieve 2,406 ft., McClosky 2,462 ft., St. Louis 2,529 ft.

Richland County: V. Hilgen 1 Taylor, SE SE NW 12-3n-8e, dry at 3,099 ft. Lower Glen Dean 2,474 ft., Cypress 2,696 ft., Aux Vases 2,970 ft., Ste. Genevieve 3,006 ft., Fredonia 3,045 ft.

Wabash County: Walter Duncan 1 J. Wollard, NW SW NE 36-1s-13w, dry at 2,700 ft. Menard 1,798 ft., Cypress 2,289 ft., Benoist 2,413 ft., Aux Vases 2,573 ft., Ste. Genevieve 2,610 ft.

Washington County: J. N. Harsh 1 Konkel, SW NW NE 35-3s-2w, dry at 1,340 ft. Glen Dean 937 ft., Cypress 1,148 ft., Benoist 1,324 ft.

## N. CENTRAL TEXAS

### Pool Opener Indicated in Northeastern Montague

WICHITA FALLS.—Nu-Enamel Operating Co. 1 J. T. Langford, Block 47, MEP&P Survey, on the southeastern edge of the Benton and Holmes pool of northeastern Montague County, on a 7-minute drill-stem test from 3,906-16 ft. made gas in 5 minutes and recoverd 625 ft. of oil and 150 ft. of oil-cut mud in 3 minutes with bottom-hole pressure of 1,675 lb. Six and five-eighths inch casing was set at 3,904 ft. It is now waiting on cement to set.

Ohio Oil Co. 2 W. R. Ross, R. B. Masterson Survey, east offset to 1 Ross, Ross Strawn pool discovery in King County, topped the Ellenburger at 6,075 ft. and is drilling at 6,148 ft.

Continental Oil Co. 1 Thomas, wildcat in Freestone County School Lands, southeastern Clay County, was drilling below 6,598 ft. in shale. Fain & McGaha Drilling & Exploration Co. 1 W. C. Frey, Parker County School Lands, wildcat 5 miles south of Petrolia, is drilling below 6,566 ft. in lime after electric log was run and no shows indicated. The same company has staked 1 J. Wiest, a 5,000-ft. wildcat, 660 ft. from the north and west lines of Section 14, Lot 78, Montague County School Lands, 5 miles southeast of Petrolia.

#### WILDCAT FAILURES COMPLETED IN NORTH CENTRAL TEXAS

Archer County: F. L. Harvey et al 1-A W. Duckworth, Blk. 6, J. W. Harris subd., 3 mi. S and 11 mi. W Archer City, elev. 1,127 ft., dry, TD 1,397 ft.

Benson Bros. 1 Julius Foerster, Blk. 73, J. L. Harris subd. of Club Ranch, 7 mi. SW Archer City, dry, TD 1,502 ft.

King County: Humble 1 L. K. Johnson, Sec. 44, F. P. Knott Sur. A-899, 17 mi. NE Guthrie, dry, TD 6,245 ft.

Throckmorton County: H. M. Kelleher and F. P. Timberlake 1 J. B. Putnam Est., Sec. 26, Comanche Indian Reservation Sur., 11 mi. SW Throckmorton, elev. 1,121 ft., dry, TD 1,150 ft.

Wichita County: A. C. Parks 2 W. B. Herron, Sec. 9, GC&SF Sur. A-361, 3 mi. N Fowlkes, elev. 1,147 ft., dry, TD 470 ft.

#### WEST CENTRAL TEXAS

ABILENE.—Roeser & Pendleton, Inc. and F. Kirk Johnson 1 Phillips, Section 67, BAL Survey, 2 miles east of the Wild Ellenburger pool in western Stephens County, swabbed 8 to 10 bbl. of oil per hour natural after drilling plug and filling up 1,600 ft. in 4 hours. Ellenburger was topped at 4,290 ft. Preparations are being made to treat with acid. Total depth is 4,307 ft.

Sinclair Prairie Oil Co. 1 E. L. Curry, TE&L Survey, 5 miles southwest of Parks Camp in Stephens County, logged lime with odor of oil from 3,450-65 ft. Caddo


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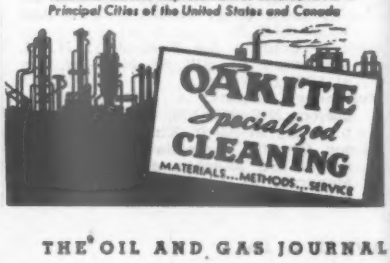

lime was topped at 3,450 ft. It was drilling below 3,490 ft. in sandy lime.

**WILDCAT FAILURE COMPLETED IN WEST CENTRAL TEXAS**

Stephens County: Northern Ordnance 1 Howard, Sec. 1218, TE&L Sur., Caddo 3,196 ft., Barnett 4,235 ft., Mississippian 4,378 ft., dry, TD 4,553 ft.

## EASTERN TEXAS

### Two Failures Scored in East Texas Wildcat Work

DALLAS.—A wildcat failure for Van Zandt County is Lone Star Producing Co. 1 J. J. Goode, D. Rose Survey, 3 miles southwest of Van. Total depth is 7,686 ft.

Shell Oil Co., Inc. and Lone Star 1 Tandy, W. Martin Survey, 12 miles north and slightly east of Centerville, Leon County wildcat, is drilling below 8,148 ft. in shale and lime after completing fishing job.

M. E. Davis 1 Mrs. Shelby, Camp County wildcat in the Thos. Williams Survey, 1 mile northeast of Newsome, is drilling below 7,809 ft. in sandy lime.

The Texas Co. 1 G. M. Morse, Caldron Survey, wildcat 1 mile south of Chandler in Henderson County, is running electrical survey with total depth of 10,620 ft. in hard sand.

Arkansas-Louisiana Gas Co. 1 Dr. F. A. Baker, Steele Survey, wildcat in southeastern Harrison County, is dry at 6,505 ft.

**WILDCAT FAILURE COMPLETED IN EASTERN TEXAS**

Upshur County: Hunt Oil 1 D. T. Bullard, L. B. Brown Sur., 5 mi. NE Bettie, elev. 467 ft., massive anhydrite 7,280 ft., Pettit 8,220-30 ft., Travis Peak 8,355 ft., dry, TD 8,550 ft.

## CANADIAN FIELDS

### Lloydminster Field Spread to Saskatchewan

CHATHAM.—In the Saskatchewan section of the Lloydminster field, the first commercial oil well in the province has been brought into production 4 miles south of Lloydminster. National Grant 1, LSD 4, 14-49-23w, finished at 1,890 ft. on 5-day test with a 2½-in. pump showed 45 bbl. a day. Production is similar to the Vermilion 14-gravity crude in Alberta, and will be processed locally for use as railway fuel. The Lloydminster field extends west across the Alberta boundary, where some oil production has been secured, while there is a large gas production in the eastern or Saskatchewan end.

**Steveville.**—In the Steveville-Princess field, eastern Alberta, California-Standard 76-22A, LSD 12, 22-20-12w4, coring in Devonian at 4,171 ft. and below the depth in which Princess-C.P.R. 18-21-A got its production, will be carried to the lower Devonian. Peerless Syndicate 1, LSD 4, 18-20-11w4, is to proceed from 2,510 ft. to test the Sunburst, and if it is noncommercial will deepen to the Devonian.

**Tempest.**—In the Tempest area, southern Alberta, Imperial-Tempest 1, LSD 4, 27-9-19w4, bottoming at 5,012 ft., was unproductive in the Devonian and plugged back to test showings in the top 20 ft. of Madison. Perforation yielded oil with some water and gas sufficient to flow the well by heads. Swabbing test is being made.

**Ram River.**—In the northern Alberta foothills, Ram River Oils 3, LSD 12, 1-37-


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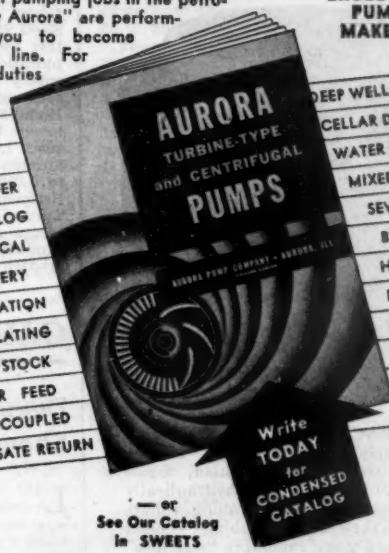


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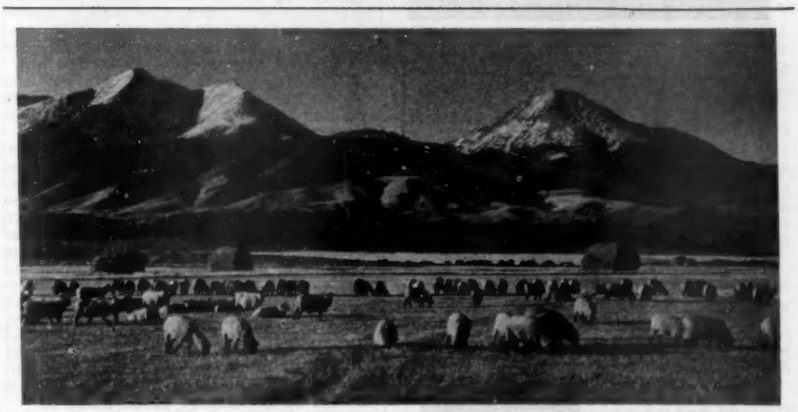

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11w5, halted drilling at 5,638 ft. to test 200 ft. of porosity in the Devonian limestone.

**Brazeau.**—Systematic testing of the Brazeau-Nordegg area in the northern foothills west of Edmonton is being undertaken by several companies. Imperial-Shell Stolberg 1, LSD 3, 22-41-14w5, a joint test by Imperial Oil, Ltd. and Shell Exploration Co., is rigging up heavy-duty rotary following extensive geological and seismographic work. To the northwest, Home-Brazeau 1, SW 17-43-17w5, is in lower Benton below 613 ft. Arrow-Brazeau 1, LSD 5, 9-41-15w5, is rigged up. Shunda 1, LSD 15, 36-40-15w5, is reaming to 1,200 ft. Geological conditions on the Brazeau structure are similar to those in Turner Valley, except that the structure seems more extensive and the potential producing formations are expected at greater depths.

# CALIFORNIA

## Deeper Eocene Sand Shows at Lost Hills

LOS ANGELES.—The most important development during the current week was the discovery of 18 ft. of oil sand from 8,750-57 ft. in Standard Oil Co. of California 58-4 Cahn at Lost Hills, 4-27s-21e. The bit was still in the pay at 8,777 ft. when preparations were made to run a Schlumberger. The prospective producer is in one of the few remaining fields in which deep-zone prospects are considered favorable. The sand is believed to be the Wagonwheel of Eocene age which has proved prolific at North Belridge and is likewise productive in the Kettleman North Dome field. The shallow sands at Lost Soldier have produced in excess of 55,000,000 bbl. to date and estimates place the present shallow-zone reserve at approximately 15,000,000 bbl.

The deep test is a joint venture with several other operators participating in drilling costs or contributing dry-hole money.

Standard's discovery is of prime importance because of a projected deep test to be drilled in the Kettleman South Dome where several Miocene tests have been drilled and abandoned because of a high head water zone quite similar to that encountered at Lost Hills. For a long time there had been some question about the closure at the south end of the Kettleman South Dome and the north end of Lost Hills. The Kettleman South Dome is northwest of Lost Hills and is the next succeeding structural high. The proposed well to be drilled in the former field will have the Eocene as its objective and this should be reached at about 10,000 ft.

Shell Oil Co., Inc. is proceeding with development of the new productive zone which it found in the Capitan field of Santa Barbara County a short time ago and should have a second well ready for a test shortly. Shell is believed to have found two additional zones although only one was proved up as productive. Capitan now has three productive horizons although not all will extend over the entire field because of faulting.

### WILDCAT FAILURES COMPLETED IN CALIFORNIA

Kern County, Jasmine: Rothschild Oil Co. 1 J.O.L., 23-25s-27e, bottomed in basement granite, Jasmine sand was barren, TD 2,310 ft.

Lerdo: Richfield 1 Lerdo, 1-28s-26e, bottomed in hard gray sand, only minor showings logged, TD 3,400 ft.

Solano County, Winchester Lake: Texas Co. 1 Winchester, 5-6n-4e, bottomed in probable basement, no showings, gas prospect well, base Tehama sand 3,042 ft., TD 4,472 ft.

# APPALACHIAN FIELD

## Speechley Sand Yields Another Big Gas Well

PITTSBURGH.—In Patton Township, Allegheny County, southwest Pennsylvania, John Wally completed the second test on the Harper estate, about 1 mile west of Monroeville, in the Speechley sand with open flow gage of 8,000,000 cu. ft. of gas daily from a total depth of 3,335 ft. Initial pay showed about 1,000,000 cu. ft. The initial discovery on this tract had an open flow of 4,000,000 cu. ft. from the same formation with the sand topped at 3,293 ft. and total depth of 3,330 ft. The discovery well, completed in Oc-

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tober 1944, has held up extremely well.

In Mercer County, United Natural Gas Co. is plugging the deep Trenton test on the Maude Davidson farm in Worth Township after acidizing the gas zones in the Trenton with noncommercial results. Total depth was 8,893 ft.

In Kiskiminitas Township, Armstrong County, J. K. Sharp et al completed a test on Bert Shellhammer farm with a gage of 327,000 cu. ft. of gas from Bradford sand at 3,337-39 ft. and total depth of 3,373 ft.

On Briery anticline in Portland district, Preston County, West Virginia, Wm. E. Snee et al abandoned the attempt to drill directionally with cable tools in the test on Harry Sisler farm which was dry through the Oriskany sand and will make a location for a second test east and south of the first location.

In Nicholas County, South Penn Natural Gas Co. has made a location for a wildcat on Mountain City Lumber Co. in the Wilderness district. In the Grant district, Columbian Carbon Co. is starting a test on the J. V. Summers tract.

In Lincoln County, R. H. Adkins completed a test on Martha Lambert heirs farm in the Jefferson district. Big lime at total depth of 1,843 ft. produced open flow of 3,489,000 cu. ft. of gas.

## ROCKY MOUNTAIN

### New Oiler in Rangely Field Being Repaired

DENVER.—In the Rangely field of Moffatt County, Colo., Stanolind Oil & Gas Co. drilled in one well, topped the Weber in a second well, and has released locations for two new wells. Its Hagood in NE SE 23-2n-103w, was drilled to a total depth of 6,555 ft. and swabbed in on March 25. After being shut in overnight, the well flowed mud and oil by heads. A hole in the 7-in. production string necessitated killing the well with mud, and it is now shut down for repairs. The productive Weber sand was reached at 5,955 ft.

Stanolind 1 Rector in NE SE 34-2n-102w, in the southeastern part of Rangely field, encountered the Weber at 5,624 ft., considerably higher than had been expected, and cored to a total depth of 5,649 ft., 7-in. production string was cemented 5 ft. in the sand at 5,629 ft. The well is now standing cemented.

Location has been released by Stanolind for 2 Hagood, an east offset to The California Co. 2 McLaughlin-Gov't, in SW NE 23-2n-103w, and for 1 Lacy, west offset to 1 McLaughlin-Gov't, in SW NW 24-2n-103w.

Development of the Rangely field is going ahead rapidly. The California Co. has four Weber sand producers and six drilling wells. Eleven other wells are being drilled in the field.

Continental Oil Co. 1 Goodstein, NE SE SW 20-57n-99w, wildcat test south of the Elk Basin field, Park County, Wyoming, recovered 8 ft. of saturated Tensleep sand in a core taken at 7,053-61 ft., and on drill-stem test at 7,024-61 ft., open 21 minutes, yielded 270 ft. of gas-cut mud and 1,170 ft. of oil. A previous test at 6,964-7,029 ft., open 15 minutes, recovered 4,380 ft. of oil. The top of the Tensleep was logged at 6,960 ft. and good saturation reported to 7,084 ft. It is planned to drill the entire Tensleep before running 5½-inch production string and completing.

**Montana deep wildcat test failure.**—Carter Oil Co. 1 Bowlen, SW NE 14-6s-19e, in Carbon County, Montana, on Fox Luther dome, tested through the Morrison without encountering showings of either oil or gas and has been abandoned at a total depth of 8,921 ft. The following tops were picked from the Schlumberger log of the well: 1st Frontier 7,424 ft., Mowry 7,700 ft., Dakota siltstone 8,380 ft., Lakota 8,716 ft., Morrison 8,742 ft. Rotary table elevation of the well, 4,928 ft.

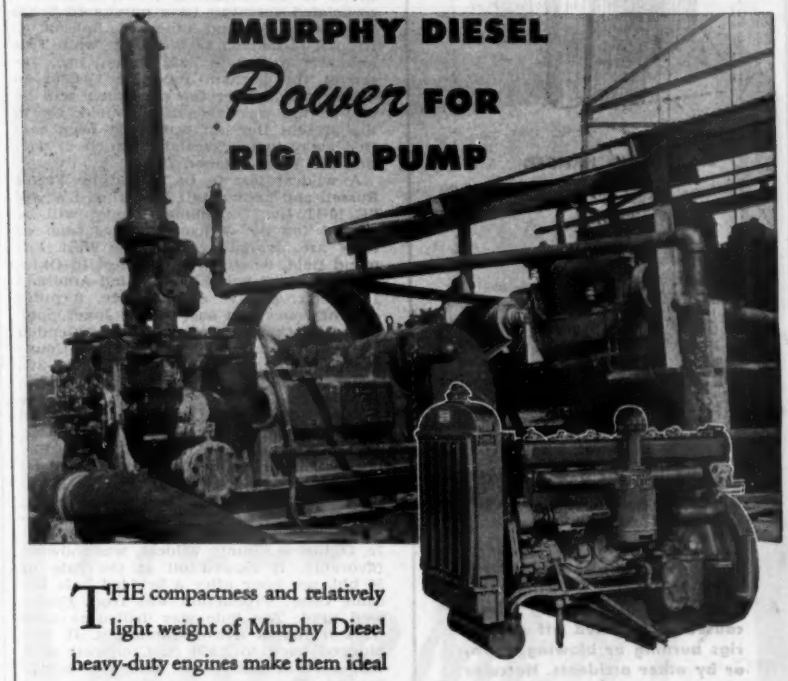
## MISSISSIPPI

### Fourth Location Made For Langsdale Pool

JACKSON.—In the Langsdale pool, of Clarke County, Mississippi, Kirby Petroleum Co. has made location for a fourth field well, the C-1 Long Bell Petroleum Co., NW NE SW 30-1n-18e, an east offset to the discovery well. Drilling rig will be moved over from A-2 Long Bell as soon as roads are completed. No. A-2 Long Bell, NW NE SE 25-1n-17e, will install pump after swabbing 120 bbl. of oil in 12 hours. Tops on this well are Wilcox 755 ft., Midway 2,310 ft., chalk 2,856 ft., and Eutaw 3,664 ft. Production came from the Eutaw at 3,660-76 ft., 3,709-22 ft. and 3,738-56 ft.

**Yazoo County.**—Southern Natural Gas Co. 1 Gammill Investment Co., 660 ft. north and 500 ft. west of SE cor. NW 5-9n-4w, is waiting on orders after swabbing salt water and oil from perforations at 6,766-78 ft. Gravity of the oil is 14.6°. Total depth at present is 8,003 ft., and top of Eutaw was cut at 7,451 ft.

**Clarke County.**—A. B. Irion et al 3 Long Bell Lumber Co., NW NW 14-2n-16e, had Midway at 2,205 ft., chalk at 2,632 ft., Eutaw at 3,700 ft., and sand at 3,708 ft. Perforations at 3,755-73 ft. and 3,844-62 ft. yielded salt water with a slight show of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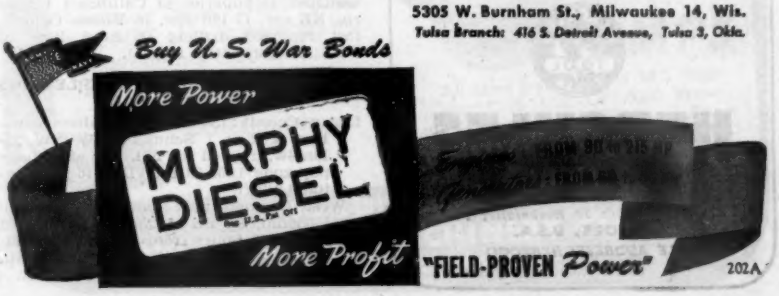


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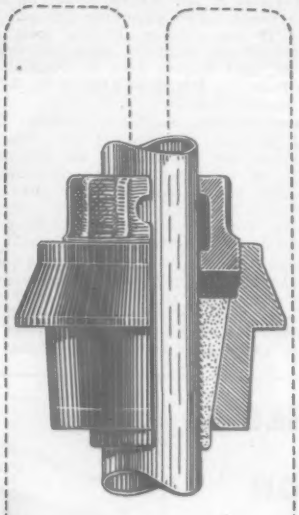

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oil. Retainer was set at 3,800 ft., and the well swabbed heavy black oil and salt water. Pumping brought salt water with only a show of oil, and the well is waiting on orders.

## OKLAHOMA

### Water Disposal Planned In West Edmond Pool

A SALT water disposal association has been organized by West Edmond field operators, with Sinclair Prairie Oil Co. as operator, and the Corporation Commission of Oklahoma has been asked for approval of the project. Hearing will be given to all concerned on April 10. The associated operators have purchased Sohio Petroleum Co. and others 1 Robson, C NE NE 12-13n-5w, as the input well. This hole was drilled to 7,228 ft. and had water in the bottom. Pipe-line system to gather and deliver the salt water will be laid in the west side of the field. Up to the present the salt water has been carried away in trucks and disposed of outside the West Edmond field.

A wildcat test to be drilled by Frank Russell and known as 1 Boecking, SW SW SE 10-11n-4w, Oklahoma County, will be started for the Wilcox sand as soon as tools are available from the West Edmond field, Another wildcat test in Oklahoma County will be Stanolind-Amerada 1 Bednar, C NW SW 23-13-1e, 8 miles east of Jones and east of the Jones pool.

Mid-Continent Petroleum Corp. extended the South Moore pool in Cleveland County with 1 Jury, NE SW SE 26-10n-3w, which flowed 485 bbl. in. 5 hours through 1-in. choke. Gas production was at the rate of 4,000,000 cu. ft. per day. Production came through perforations at 7,802-18 ft. and 7,754-84 ft., total depth 7,841 ft. Pay is Bartlesville sand. Later it flowed at the rate of 20 bbl. per hour through 16/64-in. choke and was being pinched back.

J. E. Crosbie, Inc. and Warren Petroleum Corp. 1 Sykora, NE NE SW 20-12n-7e, Okfuskee County wildcat, was showing favorably. It flowed oil at the rate of 50 bbl. per hour after a bridged hole became clear. Production was from Cromwell sand. The hole was drilled to 4,696 ft. and found Wilcox sand dry. It was plugged back to 3,950 ft. Cromwell sand was shot at 3,860-90 ft. and the bridge formed. The crew was cleaning out at last report.

Carter Oil Co. 1 McBride, SE NW 9-7n-3w, McClain County, topped Wilcox sand at 10,583 ft. and took a drill-stem test at 10,599 to 10,637 ft. and the recovery indicated a well variously estimated from 1,000 to 1,500 bbl. per day in potential production. A Schlumberger test was scheduled.

Phillips Petroleum Co. and Carter Oil Co. 1 Halsey, SE SE 28-16n-5w, Kingfisher County wildcat, was drilled to 7,865 ft., but it is a mystery well, and findings in the Wilcox have not reached the outside world. It was reported to be plugging back to test Bartlesville sand. Another tight hole, which has been closely watched, is Superior of California 1 Norris, NE cor. 17-19n-10w, in Blaine County, last reported drilling in hard lime at 9,331 ft. (estimated figure).

**SUCCESSFUL WILDCAT COMPLETIONS IN OKLAHOMA**

Logan County: New oil pool discovery—Fox & Fox 1 Schmidt, NW NW 35-18n-4w, flowed 47 bbl. per day from pay zone 4,809-73 ft., TD 4,916 ft., Layton 4,842 ft.

West Edmond pool extension—Atlantic 1 Trindl, SE SE 25-15n-5w, flowed 132 bbl. in 12 hours from Hunton at 6,940-85 ft., TD 7,232 ft., May 6,748 ft., Woodford 6,912 ft., Hunton 6,954 ft.

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**WILDCAT FAILURES COMPLETED IN OKLAHOMA**

Garvin County: Sohio 1 Blythe, NW NW NW 29-1n-1e, TD 5,456 ft.

Continental and Stanolind 1 Kennebrew, NE NE NW 27-3n-1e, dry, TD 3,674 ft., bromide 3,260 ft.

Hughes County: Wilcox et al 1 Rogers, SW NW SE 28-9n-9e, dry, TD 3,510 ft., Cromwell 3,385 ft.

Payne County: Hanlon-Buchanan 1 Focht, SE SW NE 18-19n-2e, dry, TD 4,551 ft., Misener 4,548 ft.

Stephens County: Carl Carter 1 Jones, SW SW SE 13-1s-5w, dry, TD 3,503 ft.

## LA.-ARK.

### Holly Ridge Field Gets New Gas Producer

SHREVEPORT. — Union Producing Co. 14 Penrod-Jurden, SW NE 20-11n-10e, in the Holly Ridge field of Tensas Parish, has been completed as a 10,000,000 cu. ft. gas well. Production was from perforations in the Wilcox at 3,038-40 ft., and total depth of the hole was 8,544 ft., plugged back to 3,088 ft.

In West Carroll Parish, the California Co. 1 Hodge and Hunt Lumber Co., SW NW 6-19n-9e, a wildcat 9 miles north of Delhi, cored at 2,782-92 ft., and recovered 10 ft. of dry sand. The well is now drilling at 3,260 ft.

Three input wells have been authorized for the Magnolia area of Columbia County, Arkansas. The first input well drilled in this field proved the feasibility of injection of salt water into the Smackover lime, and that this conservative measure will arrest the decline in pressure in the field. Carter Oil Co. will drill these three inputs, which are authorized as 1 Awbrey, 1,150 ft. west and 200 ft. south of NE cor. NW 27-17s-20w; 1 Blewster, S½ NE NW 14-17s-20w, and 1 Gunnels, 1,660 ft. north and 1,834 ft. east of SW cor. NW 18-17s-19w.

**WILDCAT FAILURE COMPLETED IN ARKANSAS**

Union County: C. H. Murphy, Jr. 1 Murphy, 660 ft. west and 531 ft. south of NE cor. of Sec. 4-19s-15w, dry, TD 7,870 ft.

**WILDCAT FAILURE COMPLETED IN NORTH LOUISIANA**

Bienveille Parish: T. L. James 1 South Advance Bag & Paper Co., 872 ft. north and 449 ft. west of SE cor. of NW 23-17n-7w, dry, TD 6,335 ft.

**LEGAL**

U. S. DEPARTMENT OF THE INTERIOR, General Land Office, Washington, D. C. Notice is hereby given that the lands herein described within the Midway Dome oil field, 6th P.M., Wyoming, are offered to qualified bidders of the highest cash amounts offered per acre as a bonus for the privilege of leasing the land under section 17 of the leasing act, as amended by the act of August 21, 1935 (49 Stat. 674, 30 U. S. C. sec. 226), in the following parcels: Parcel No. 1, T. 35 N., R. 78 W., sec. 19, lots 1 and 2, 72.50 acres. Parcel No. 2, T. 35 N., R. 79 W., sec. 2, S½SW¼, SW¼SE¼, 120 acres. Parcel No. 3, T. 35 N., R. 79 W., sec. 10, SE¼NE¼, 40 acres. Total acreage 232.50 acres. Sealed bids will be received in the office of the Commissioner of the General Land Office, Interior Department Building, Washington 25, D. C., up to 12 noon May 2, 1945. Bids must be submitted on each parcel separately but if two or more parcels are awarded to the same bidder they may be included in a single lease. Each bidder must submit a certified check or cash for one-fifth of the amount bid, payable to the order of the Treasurer of the United States, and file the showing of qualifications to receive a lease required by section 7 of Circular 1386. The remainder of the bonus bid and the first year's rental at the rate of $1 per acre must be paid and a $5,000 corporate surety bond must be filed by the successful bidders prior to the issuance of the leases. The deposits of the other bidders will be returned upon acceptance of the successful bids by the Secretary of the Interior. The envelopes should be plainly marked "Bid for Parcel No. ———, Midway Dome oil field, Wyoming. Not to be opened before noon May 2, 1945." No bids received after the date fixed herein for submitting bids will be considered. The successful bidder will be required to agree not to discriminate against any employee or applicant for employment because of race, creed, color, or national origin, and to require an identical provision to be included in all subcontracts. Bidders are warned against violation of section 59, U. S. Criminal Code, approved March 4, 1909, prohibiting unlawful combination or intimidation of bidders. The right is reserved to reject any and all bids in the discretion of the Secretary of the Interior. Fred W. Johnson, Commissioner.

## OHIO, KENTUCKY

### Mile Extension or New Pool Discovery Hit in Perry

COLUMBUS. — A 1-mile northwest extension to the Clayton pool or what may be a new pool was found at Wiser Oil Co. 1 Carl W. Ream, Section 36, Hopewell Township, Perry County. Clinton sand at 3,077-3,113 ft. was shot and made 97 bbl. in 24 hours with considerable gas.

Wehrle 2 A. A. Lee, Section 21, Clayton Township, Perry County, a Clinton sand gas well 1 mile southeast of the Clayton pool, was shot and made 50 bbl.

The South Lakeville pool was extended a location to the east by the Ohio Fuel Gas Co. 1 C. N. Maurer, Section 1, Washington Township, Holmes County. Clinton

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at 2,962-93 ft. was shot and gaged 1,580,000 cu. ft. when shut in.

**WILDCAT FAILURE IN OHIO**

Summit County, Richfield Township: Frank Brendel 1 Frank Mategka, Lot 1, Clinton 3,481-3,518 ft., dry, TD 3,615 ft.

**EASTERN KENTUCKY**

ASHLAND. — Extensive operations were reported in the eastern Kentucky field during the week just ended, including completion of three gas wells with a total open flow of 3,606,000 cu. ft. of gas.

The largest of the three wells was reported by the Inland Gas Corp., completing No. 270 on the Emmanuel Meads land on Abbott Creek in Floyd County, at a total depth of 819 ft., with a daily open flow of 2,040,000 cu. ft. of gas in the Maxon.

The Kentucky-West Virginia Gas Co. completed No. 765 on the Helen Leslie land on John's Creek in Pike County, at a total depth of 2,942 ft., with a daily open flow of 1,185,000 cu. ft. of gas in shale.

Kentucky-West Virginia Gas. completed No. 5,529 on the William Hamilton land on Big Mud Creek in Floyd County, at a total depth of 2,794 ft., with a daily open flow of 381,000 cu. ft. of gas in shale.

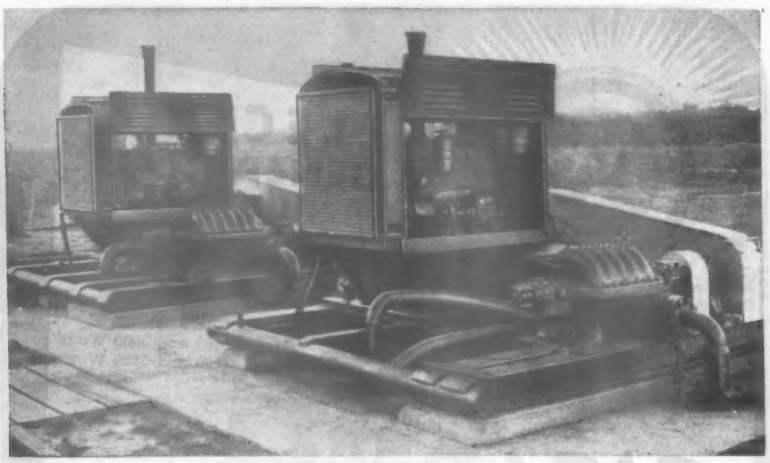
Several drilling operations were reported by the Ashland Oil & Refining Co., but none of the oil wells were marked as completed.

**WESTERN KENTUCKY**

Two new wildcat locations have been staked for Western Kentucky, one for Henderson County and one for Union County. In Henderson, F. Fleming and A. K. Swann 1 Patterson, 1-0-22, 2 miles east of Corydon, is a location for a rotary test. In Union County, South Penn Oil Co. 1 Stevenson, 14-N-18, ¼ mile west of Henshaw, is preparing for a 3,400 ft. cable tool McCloskey test.

**INDIANA**

Only one well was reported completed in Indiana this week, that being F. E. Poe 3 Duncan, SE SE NE 2-2s-10w, in Gibson County. The test was a failure after being carried to a total depth of 1,414 ft. Glen Dean was topped at 1,340 ft., and elevation was 468 ft.

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For complete information, write *Penn Electric Switch Co., Goshen, Ind.* Export Division: 13 E. 40th Street, New York 16, U.S.A. In Canada: Powerlite Devices, Ltd., Toronto, Ont.

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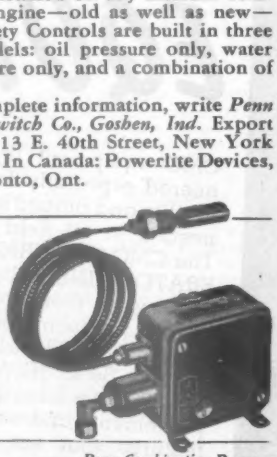
**Battery Ignition Applications.** Opens battery circuit and sounds an alarm . . . sounds an alarm only . . . opens battery circuit only.

**Magneto Ignition Applications.** Sounds an alarm only . . . grounds dual magneto . . . grounds magneto only . . . grounds magneto and sounds an alarm or lights a signal light.

**Dual Ignition Applications.** Opens battery circuit and grounds magneto.



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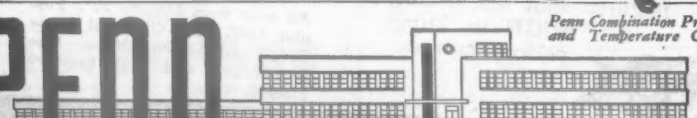

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# KANSAS

## Ellis County Wildcat Swabs 4 Bbl. Per Hour

DARBY & BOTHWELL 1 Richards, SE SE SW 6-11-18w, 1 mile south of the Richards pool in northern Ellis County, is swabbing 4 bbl. of oil per hour, after acid, from the Lansing. Good porosity but no saturation was found in the Arbuckle at 3,585-3,610 ft. Pipe was set at 3,450 ft., the well was perforated from 3,378-85 ft., and swabbed 1 bbl. per hour natural. Three shots of acid, 1,000 gal., 1,500 gal., and 4,000 gal. improved the production to 4 bbl. per hour.

**Butler County:** Skelly Oil Co. 1 Smith, SW SW SE 9-28-5e, wildcat, had Lansing at 1,780 ft., Kansas City at 2,182 ft., and Mississippi at 2,772 ft. A small show of oil was logged in the Lansing at 1,863-71 ft. Total depth of the hole is 2,805 ft., and 7-in. pipe was set at 2,460 ft.

**Dickinson County:** National Drilling Co. 1 Doyle, CEL NE SE 22-16-4e, is moving in pumping equipment after having 2,000 ft. of oil in the hole, at a total depth of 2,308 ft. The Mississippi lime was topped at 2,278 ft. National has staked the south offset to this well, No. 1 Dombrowski, S/2 SE 22-16-4e. These two tests are just north of the Lost Springs pool of Marion County.

**Reno County:** Tom Allen et al 1 Snook, SW NW SW 10-22-8w, a wildcat southeast of the Sterling pool, has set 5-in. pipe at 3,554 ft., and are perforating to test. Tops for this well are Topeka 2,500 ft., Lansing 2,971 ft., Viola 3,447 ft., Simpson 3,488 ft., Arbuckle 3,554 ft.

**SUCCESSFUL WILDCAT COMPLETION IN KANSAS**

Graham County: New oil pool discovery—Wood River Oil 1 Faulkner, SW SE SE 27-10-22w, potential of 406 bbl. from Kansas City at 3,629-33 ft., TD 4,100 ft., PB 3,800 ft., Kansas City 3,551 ft., Marmaton 3,807 ft., Simpson 3,956 ft., Arbuckle 3,963 ft.

**WILDCAT FAILURES COMPLETED IN KANSAS**

Barber County: Alladin 1 Hastings, E/2 SE NE 31-30-14w, dry, TD 4,575 ft.

Pratt County: Amerada 1 Drews, SE SE NW 3-27-12w, dry, TD 4,634 ft., Arbuckle 4,601 ft.

Rooks County: Royer & Farris 1 Baldwin, NW NW NW 9-10-19w, dry, TD 3,784 ft., Arbuckle 3,767 ft.

**FOREST CITY BASIN**

ST. JOSEPH, Mo.—Claude McQueen 1 Patterson, NW NE 14-64n-38w, Nodaway County, Missouri, has been abandoned at 1,225 ft. and rig was skidded 30 ft. south for 1-A Patterson because of a bad fishing job. The location is 4 miles west of Quitman.

Fell & Reid 1 Fred Klam, SE SE SE 19-51n-33w, Platte County, Missouri, northeast of Parkville, was drilling at 1,140 ft.

In the Kansas sector of the basin, Clifton Gall et al 1 Husted was drilling below 2,000 ft. as the first offset to 1 Livengood Hunton lime discovery well. Dan McLaughlin 1 Allen, NW NE 32-8s-16e, Jackson County, Kansas, was drilling at 2,693 ft., having topped Hunton lime at 2,515 ft.

# WILDCAT COMPLETIONS AND DISCOVERIES

| | Week ended Mar. 31, 1945 | | | | | Cumulative total, 1945 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Oil | Dist. | Gas | Dry | Total | Oil | Dist. | Gas | Dry | Total |
| Ohio | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 5 | 15 | 20 |
| Indiana | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 3 | 4 |
| Illinois | 1 | 0 | 0 | 7 | 8 | 16 | 0 | 0 | 58 | 74 |
| Kentucky | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 1 | 10 | 13 |
| Michigan | 0 | 0 | 0 | 5 | 5 | 1 | 0 | 0 | 58 | 59 |
| Kansas | 1 | 0 | 0 | 3 | 4 | 9 | 0 | 4 | 79 | 92 |
| Neb., Mo., Iowa | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 8 | 8 |
| Oklahoma | 2 | 0 | 0 | 5 | 7 | 28 | 0 | 3 | 70 | 101 |
| Texas: | | | | | | | | | | |
| North Central | 0 | 0 | 0 | 6 | 6 | 30 | 0 | 3 | 104 | 137 |
| West | 1 | 0 | 0 | 5 | 6 | 14 | 0 | 0 | 71 | 85 |
| Panhandle | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 1 | 3 | 4 |
| Eastern | 0 | 0 | 0 | 1 | 1 | 5 | 2 | 0 | 19 | 26 |
| Gulf Coast | 1 | 0 | 0 | 6 | 7 | 18 | 1 | 10 | 67 | 96 |
| Southwest | 1 | 1 | 0 | 1 | 3 | 6 | 1 | 3 | 44 | 54 |
| Total Texas | 3 | 1 | 1 | 19 | 24 | 73 | 4 | 17 | 308 | 402 |
| Louisiana: | | | | | | | | | | |
| Northern | 0 | 0 | 0 | 1 | 1 | 1 | 0 | 1 | 18 | 20 |
| Southern | 1 | 0 | 0 | 1 | 2 | 8 | 0 | 0 | 12 | 20 |
| Total Louisiana | 1 | 0 | 0 | 2 | 3 | 9 | 0 | 1 | 30 | 40 |
| Arkansas | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 14 | 14 |
| Mississippi | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 27 | 30 |
| Ala., Ga., Florida | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 7 | 7 |
| Montana | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 3 | 6 |
| Wyoming | 0 | 0 | 0 | 0 | 0 | 6 | 0 | 0 | 8 | 14 |
| Colorado-Utah | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 3 |
| New Mexico | 0 | 0 | 0 | 1 | 1 | 3 | 0 | 1 | 17 | 21 |
| California | 0 | 0 | 0 | 3 | 3 | 0 | 0 | 2 | 51 | 53 |
| Total United States | 8 | 1 | 1 | 47 | 57 | 154 | 4 | 34 | 769 | 961 |
| Total previous week | 11 | 0 | 3 | 57 | 71 | | | | | |

## LEGAL

U. S. DEPARTMENT OF THE INTERIOR, General Land Office, Washington, D. C. Notice is hereby given that the lands herein described within the known geologic structure of the Bunker Hill gas field, Wyoming, are offered to the responsible qualified bidders of the highest cash bonus per acre for lease under section 17 of the mineral leasing act, as amended by the act of August 21, 1935 (49 Stat., 674, 30 U.S.C. sec. 226), in the following parcels: T. 26 N., R. 89 W., Parcel No. 1, sec. 4, lots 3 and 4; sec. 5, lots 1 and 2, 168.10 acres. T. 27 N., R. 89 W., Parcel No. 2, sec. 19, S½SE¼; sec. 20, S½SW¼, 160 acres. Parcel No. 3, sec. 30, NE¼, 160 acres. Parcel No. 4, sec. 30, SE¼, 160 acres. Parcel No. 5, sec. 31, N½NE¼, SE¼NE¼, 120 acres. Parcel No. 6, sec. 32, NW¼SW¼, 40 acres. Parcel No. 7, sec. 32, SE¼SW¼, S½SE¼; sec. 33, SW¼SW¼, 160 acres. Parcel No. 8, sec. 33, SE¼NW¼, E½SW¼; 120 acres. Parcel No. 9, sec. 28, SW¼SW¼; sec. 33, NW¼ NW¼, 80 acres. Total acreage, 1168.10 acres. The minimum bid which will be accepted is $1.00 per acre. Sealed bids will be received in the office of the Commissioner of the General Land Office, Interior Building, Washington 25, D. C., up to twelve noon April 10, 1945. Bids must be submitted on each parcel separately, but if two or more parcels are awarded to the same bidder they may be combined in a single lease provided the acreage does not exceed 640 acres. Each bidder must submit a certified check or cash for one-fifth of the amount bid payable to the order of the Treasurer of the United States and file the showing of qualifications to receive a lease required by section 7 of Circular 1386. The remainder of the bonus bid and the annual rental at the rate of $1.00 per acre must be paid, and a $5,000 corporate surety bond must be furnished by the successful bidder prior to the issuance of the lease. The deposits of the other bidders will be returned upon acceptance of the successful bid by the Secretary of the Interior. The envelopes should be plainly marked "Bid for Parcel No....., Bunker Hill gas field. Not to be opened before noon April 10, 1945." No bids received after the hour fixed herein for submitting bids will be considered. The successful bidders will be required to agree not to discriminate against any employee or applicant for employment because of race, creed, color, or national origin and to require an identical provision to be included in all subcontracts. Bidders are warned against violation of section 59, U. S. Criminal Code, approved March 4, 1909, prohibiting unlawful combination or intimidation of bidders. The right is reserved to reject any and all bids in the discretion of the Secretary of the Interior. Fred W. Johnson, Commissioner.

## LEGAL

UNITED STATES DEPARTMENT OF AGRICULTURE, Forest Service, Jackson, Mississippi, March 29, 1945. Sealed bids in duplicate will be received until 10:00 A. M., Central War Time, May 2, 1945, and then publicly opened offering bonus for operating rights in connection with gas and oil leases on seventeen parcels of national forest land located in Smith and Wayne Counties, Mississippi. Parcel number one contains approximately 2,373 acres in Township 3 North, Range 7 East, Sections 10, 13, 14, 15, 22, 23 and 24. Parcel number two contains approximately 593 acres in Township 7 North, Range 8 West, Section 19. Parcel number three contains approximately 436 acres in Township 7 North, Range 8 West, Section 18. Parcel number four contains approximately 441 acres in Township 7 North, Range 9 West, Section 13. Parcel number five contains approximately 517 acres in Township 6 North, Range 9 West, Section 3. Parcel number six contains approximately 434 acres in Township 6 North, Range 9 West, Section 4. Parcel number seven contains approximately 240 acres in Township 7 North, Range 9 West, Section 33. Parcel number eight contains approximately 480 acres in Township 7 North, Range 9 West, Section 32. Parcel number nine contains approximately 640 acres in Township 7 North, Range 9 West, Section 29. Parcel number ten contains approximately 439 acres in Township 7 North, Range 9 West, Section 15. Parcel number eleven contains approximately 440 acres in Township 7 North, Range 9 West, Section 21. Parcel number twelve contains approximately 319 acres in Township 7 North, Range 9 West, Section 22. Parcel number thirteen contains approximately 464 acres in Township 7 North, Range 9 West, Section 27. Parcel number fourteen contains approximately 200 acres in Township 7 North, Range 9 West, Section 36. Parcel number fifteen contains approximately 396 acres in Township 6 North, Range 8 West, Section 6. Parcel number sixteen contains approximately 236 acres in Township 7 North, Range 8 West, Section 31. Parcel number seventeen contains approximately 556 acres in Township 7 North, Range 8 West, Section 30. Separate bids will be received on the seventeen parcels. Award of lease will be made only to bidder who can show sufficient experience and financial resources and prove citizenship. Interested parties may obtain bid documents, lease forms and operating regulations from the Forest Supervisor, Masonic Building, U. S. Forest Service, Jackson 114, Mississippi.

## LEGAL

U. S. DEPARTMENT OF THE INTERIOR, General Land Office, Washington, D. C. Notice is hereby given that the lands herein described in the Bueyeros carbon dioxide area, within the limits of the known geologic structure of producing carbon dioxide fields, undefined, New Mexico, are offered to the responsible qualified bidders of the highest cash bonus per acre for lease under section 17 of the mineral leasing act, as amended by the act of August 21, 1935 (49 Stat. 674, 30 U.S.C. sec. 226), in the following parcels: Parcel No. 1, T. 19 N., R. 29 E., sec. 3, SE¼NE¼, 40 acres. Parcel No. 2, T. 19 N., R. 29 E., sec. 10, N½NE¼, 80 acres. Parcel No. 3, T. 19 N., R. 29 E. sec. 10, SE¼SW¼, 40 acres. Parcel No. 4, T. 20 N., R. 30 E., sec. 14, S½SW¼, 80 acres. Parcel No. 5, T. 20 N., R. 30 E., sec. 15, N½SW¼, 80 acres. Parcel No. 6, T. 20 N., R. 30 E., sec. 15, SE¼SE¼, 40 acres. Parcel No. 7, T. 20 N., R. 30 E., sec. 22, N½NE¼, NE¼NW¼, 120 acres. Parcel No. 8, T. 21 N., R. 30 E., sec. 3, W½NW¼, SE¼NW¼, sec. 4, NE¼, E½SE¼, 360.80 acres. Parcel No. 9, T. 21 N., R. 30 E., sec. 3, SE¼SE¼, 40 acres. Parcel No. 10, T. 21 N., R. 30 E., sec. 4, SW¼, sec. 9, NW¼NW¼, 200 acres. Parcel No. 11, T. 21 N., R. 30 E., sec. 5, NE¼NE¼, 41.76 acres. Parcel No. 12, T. 21 N., R. 30 E., sec. 5, SE¼SW¼, sec. 8, NE¼NW¼, 80 acres. Parcel No. 13, T. 21 N., R. 30 E., sec. 8, SE¼, 160 acres. Parcel No. 14, T. 21 N., R. 30 E., sec. 9, E½NE¼, SW¼NE¼, NE¼SE¼, 160 acres. Parcel No. 15, T. 21 N., R. 30 E., sec. 10, NE¼SW¼, SE¼, sec. 11, SW¼NW¼, W½SW¼, sec. 14, NW¼-NW¼, 360 acres. Parcel No. 16, T. 21 N., R. 30 E., sec. 15, NE¼ NW¼SE¼, 200 acres. Parcel No. 17, T. 21 N., R. 30 E., sec. 17, W½E½, SE¼NE¼, E½SE¼, 280 acres. Parcel No. 18, T. 21 N., R. 30 E., sec. 20, E½, SE¼NW¼, NE¼SW¼, S½-SW¼, 480 acres. Parcel No. 19, T. 21 N., R. 30 E., sec. 21, W½NW¼, N½SW¼, SE¼SW¼, 200 acres. Parcel No. 20, T. 21 N., R. 30 E., sec. 22, SE¼NE¼, 40 acres. Parcel No. 21, T. 21 N., R. 30 E., sec. 22, SE¼SE¼, 40 acres. Parcel No. 22, T. 21 N., R. 30 E., sec. 29, SE¼NE¼, 40 acres. Parcel No. 23, T. 21 N., R. 30 E., sec. 29, S½SE¼, 80 acres. Total 3,242.56 acres. Annual rental will be at the rate of 25 cents per acre so long as the lands within the limits of the known geologic structure of producing gas fields embracing these lands is productive of gas only but upon discovery of a valuable deposit of oil in any one of the structures on which any of the lands are located, the annual rental on that structure will be not less than $1 per acre. Sealed bids will be received in the office of the Commissioner of the General Land Office, Interior Building, Washington 25, D. C., up to twelve noon April 30, 1945. Bids must be submitted on each parcel separately, but if two or more parcels in Groups Nos. 1 to 3 inclusive, Nos. 4 to 7 inclusive, and Nos. 21 to 23 inclusive are awarded to the same bidder, the parcels in each group may be combined in a single lease, and if two or more parcels in Group Nos. 8 to 20 inclusive, are awarded to the same bidder they may be combined in a single lease provided the aggregate acreage does not exceed 640 acres. Each bidder must submit a certified check or cash for one-fifth of the amount bid payable to the order of the Treasurer of the United States and file the showing of qualifications to receive a lease required by section 7 of Circular 1386. The remainder of the bonus bid and the annual rental at the rate of 25 cents per acre must be paid, and a $5,000 corporate surety bond must be furnished by the successful bidder prior to the issuance of the lease. The deposits of the other bidders will be returned upon acceptance of the successful bids by the Secretary of the Interior. The envelopes should be plainly marked "Bid for Parcel No. , Bueyeros carbon dioxide area, New Mexico. Not to be opened before noon April 30, 1945." No bids received after the hour fixed herein for submitting bids will be considered. The successful bidders will be required to agree not to discriminate against any employee or applicant for employment because of race, creed, color, or national origin and to require an identical provision to be included in all subcontracts. Bidders are warned against violation of section 59, U. S. Criminal Code, approved March 4, 1909, prohibiting unlawful combination or intimidation of bidders. The right is reserved to reject any and all bids in the discretion of the Secretary of the Interior. Fred W. Johnson, Commissioner.

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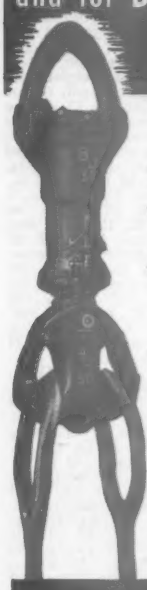

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# Among the Drilling Contractors

**Patrick & Tyrrell Drilling Co.**, Houston, is preparing to start operations on Gulf Refining Co. 1 E. S. Gambrell, SW NE 34-10n-14w, Smith County, Mississippi, a wildcat location on the Taylorsville prospect.

**Huckelberry & Cline Drilling Co.**, Oklahoma City, has contract to drill George W. Lyles 1 L. L. Billings, 11-4n-1e, a new wildcat operation in Rankin County, Mississippi.

**R. D. Morgan**, Shreveport, is the drilling contractor on J. L. Cates 1 J. A. Steel, 6-21n-2e, Greene County, Alabama, wildcat test.

**Mercury Drilling Co.** is rigging up rotary on The Texas Co. 1 L. C. Hutchings, in SE SE SW 26-27s-3e, Butler County, Kansas.

**Hollandsworth Drillings Co.** has taken out a permit to do business in Oklahoma City, and is opening an office in that city. The company is engaged in straight contract and joint-operation work.

**General Petroleums**, of Calgary, Alta., has been awarded the drilling contract on three additional wells in western Saskatchewan for Bata Petroleums, of Regina. Locations are being made by Dr. J. O. G. Sanderson, geologist, of Calgary.

**Pacific Drilling Co.**, Los Angeles, has been awarded the contract to drill the Capital Co. 1-3 Cole, in the Turnbull Canyon district of Los Angeles County, California.

**Drilling & Production Co.**, which recently completed a deep well in the Ventura Avenue field of California for Ralph Lloyd, is preparing to begin well No. 16 for the same operator.

**Camay Drilling Co.** has the drilling contract on the Union Oil Co. 1-13 Bradley Lands, in 25-10n-34w, at Santa Maria Valley, California.

**Olson Drilling Co.** has staked location for a 6,000-ft. test in SE SW SE 29-3n-7w, in extreme southern Grady County, Oklahoma. The test is the 1 Pfile B, and is north of the No. 1 test completed last year by the operator at a total depth of 3,512 ft.

Guy Mabee, Midland, Tex., of **Mabee Drilling Co.**, has been named chairman of the West Texas-New Mexico chapter of the American Association of Oil Well Drilling Contractors.

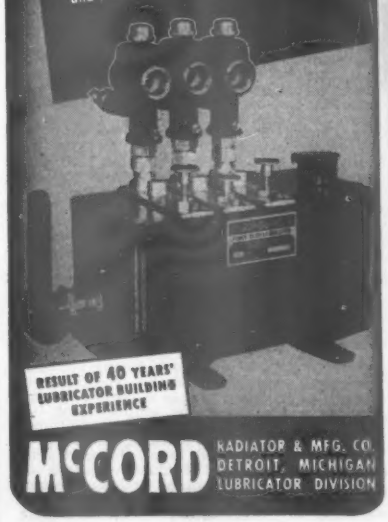
**Merrill Drilling Co.** will drill the J. V. Wicklund Development Co. 1 Edward E. Hein, in SE SE SE 13-14n-6w, Isabella County, Michigan.

**C. B. Miller** is the drilling contractor on the Alan W. Winchester A-2 William Commans, in SE NW NW 27-3n-13w, Allegan County, Michigan.

**Stuart Godfrey** has been awarded contract to drill the Socony-Vac-

McCORD
Class S.F.
LUBRICATORS

A modern lubricator for modern service on Diesel, gas, steam engines and compressors. Supplies dependable cylinder lubrication in metered quantities reducing friction and wear. Capacities: 2 to 24 pt. and ¼ to 16 feeds. New catalog on request.



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McCORD RADIATOR & MFG. CO. DETROIT, MICHIGAN LUBRICATOR DIVISION

uum Oil Co., Inc. 1 J. Abbott, in NE NE SW 23-1s-16w, Van Buren County, Michigan.


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COMPOUND YOUR PUMPS

. . . the convenient, economical way. Install UNIBOLT "BIG INCH" COUPLINGS with Blanking Plugs on your pump suctions.

THORNHILL-CRAVER COMPANY—HOUSTON


# MARKET QUOTATIONS

**Prices as of April 3, 1945**

**(This service is abbreviated because most refinery products are selling at the Government's price ceilings. Quotations on other products than those shown here furnished on request. Quotations are f.o.b. plant in tank cars and in cents per gallon.)**

## REFINERY GASOLINE

| | 78† | 70-74 |
|---|---|---|
| Octane (A.S.T.M.) | | |
| Mid-Continent* | 6.75 | 5.875 |
| Gulf Coast | 6.75 | 5.825 |
| Northeast Coast | ... | 9.075 |
| California | ... | 6.50-7.00 |

*Basic Oklahoma Group 3. †1939 C.F.R. (research method).

## NATURAL GASOLINE

| Grades: | 26-70 | 18-35 |
|---|---|---|
| Oklahoma (Group 3) | 4.500 | 5.400 |
| North Texas (Dist. 1 Del.) | 4.500 | 5.400 |
| North Texas (f.o.b. plant) | 4.125 | 4.950 |
| North Louisiana (Dist. 1 Del.) | 5.160 | 6.060 |
| North Louisiana (f.o.b. plant) | 4.375 | 5.250 |
| California | 4.875 | 5.500 |

## CRUDE-OIL PRICES

| Representative posted schedules per | bbl. |
|---|---|
| East Texas | $1.25 |
| Conroe | 1.43 |
| Tepetate, Louisiana | 1.18 |
| Illinois Basin | 1.37 |
| Pecos County, Texas | .95 |
| Bradford, Pennsylvania | 3.00 |
| Van, Van Zandt County, Texas | 1.08 |

Note: Exclusive of subsidy.

## GRAVITY SCHEDULES

Top prices include all gravities above grades designated, and low prices include all gravities below grades designated:

| Gravity— | Signal Hill, Calif. | Okla-homa Kansas | Gulf Coast Texas | West Tex.* |
|---|---|---|---|---|
| 18-18.9 | $0.80 | .... | .... | .... |
| 19-19.9 | .84 | .... | $1.06 | $0.70 |
| 20-20.9 | .88 | $0.85 | 1.08 | .72 |
| 21-21.9 | .92 | .87 | 1.10 | .74 |
| 22-22.9 | .96 | .89 | 1.12 | .76 |
| 23-23.9 | 1.00 | .91 | 1.14 | .78 |
| 24-24.9 | 1.03 | .93 | 1.16 | .80 |
| 25-25.9 | 1.07 | .95 | 1.18 | .82 |
| 26-26.9 | 1.11 | .97 | 1.20 | .84 |
| 27-27.9 | 1.15 | .99 | 1.22 | .86 |
| 28-28.9 | 1.18 | 1.01 | 1.24 | .88 |
| 29-29.9 | 1.20 | 1.03 | 1.26 | .90 |
| 30-30.9 | 1.23 | 1.05 | 1.28 | .92 |
| 31-31.9 | .... | 1.07 | 1.30 | .94 |
| 32-32.9 | .... | 1.09 | 1.32 | .96 |
| 33-33.9 | .... | 1.11 | 1.34 | .98 |
| 34-34.9 | .... | 1.13 | 1.36 | 1.00 |
| 35-35.9 | .... | 1.15 | 1.38 | 1.02 |
| 36-36.9 | .... | 1.17 | 1.40 | 1.04 |
| 37-37.9 | .... | 1.19 | 1.42 | 1.06 |
| 38-38.9 | .... | 1.21 | 1.44 | 1.08 |
| 39-39.9 | .... | 1.23 | 1.46 | 1.10 |
| 40 and above | .... | 1.25 | 1.48 | 1.12 |

*Includes Lea County, New Mexico.

## A.P.I. REFINERY REPORT

**Week ended March 24, 1945**

**(Figures in thousands of barrels)**

| | Dly. crude runs to stills | Stocks Gasoline | Stocks Distillate | Stocks Residual |
|---|---|---|---|---|
| East Coast | 713 | 13,838 | 5,285 | 5,618 |
| Appalachian | 156 | 3,971 | 493 | 411 |
| Ill., Ind., Ky. | 779 | 24,239 | 3,351 | 1,846 |
| Okla., Kan., Mo. | 384 | 9,872 | 1,591 | 1,188 |
| Inland Texas | 233 | 3,085 | 335 | 599 |
| Tex. Gulf Coast | 1,087 | 16,426 | 5,038 | 6,315 |
| La. Gulf Coast | 284 | 5,040 | 1,903 | 1,502 |
| N. La., Ark. | 69 | 3,000 | 707 | 284 |
| Rocky Mtn. | 130 | 2,593 | 384 | 820 |
| California | 907 | 16,948 | 7,615 | 24,944 |
| Total 3-24-45 | 4,742 | *99,012 | 26,782 | 43,327 |
| Total 3-17-45 | 4,773 | 98,882 | 26,483 | 43,718 |
| Total 3-25-44 | 4,466 | 85,583 | 30,925 | 52,475 |

Military, 45,525; civilian, 53,487.

## CRUDE-OIL STOCKS

**(Bureau of Mines Estimate)**

| Week ended: | Bbl. of crude* |
|---|---|
| March 24, 1945 | 221,227,000 |
| March 17, 1945 | 219,486,000 |
| March 25, 1944 | 236,285,000 |

*Excludes unrefinable California stocks.


PENBERTHY

"REFLEX"

WATER GAGE SET

For oil field, locomotive type and marine boilers. Water shows black — steam shows white; the water level is unmistakable. U-Bolt construction is strongest and simplest to service. Glass replaced by simply removing nuts on face of gage . . . unnecessary to work between gage and boiler. Conforms with A.S.M.E., Federal and State requirements when used for pressures specified by their respective codes.

This is one of the complete line of Penberthy gages that meet every liquid level gage requirement.

PENBERTHY INJECTOR CO.

DETROIT, MICH. Canadian Plant WINDSOR, ONTARIO

EIGHT interchangeable cutters. Fast cutting action, directed at 30 degree angle, cutters are hard surfaced steel. See Composite Catalog or write for Bulletin and additional information.

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BRANCHES: HOUSTON, TEXAS · LAKE CHARLES, LA. BAKERSFIELD, VENTURA AND AVENAL, CALIFORNIA

# PERSONALS

## Liked Other States And Expects to Like Kansas

GEOFFREY STEWART TAITT, named acting division manager of the Kansas division, production department, of Shell Oil Co., Inc., says he has "sampled the United States in Minnesota, California and Texas, found extraordinarily nice folks and expects to find more in his new job."

After graduating in mechanical engineering at Swindon College, England, Taitt served an apprenticeship in the locomotive department of Great Western Railway in that country before joining the Shell Group in 1928. Since then he has worked in various phases of production and exploitation engineering with Shell affiliated companies in Romania, Venezuela, Borneo and Trinidad, and also at the Hague, Holland. For the past 2¼ years he has been at the Texas-Gulf headquarters of Shell Oil Co., Inc., at Houston.

Taitt came to this country in 1942. In his new post, with offices at Shell's division headquarters in Wichita, Kans., he takes the place of Dr. E. W. Clark, who has received an assignment in Venezuela.

**J. W. Hoover,** head of the geophysical department of Standard Oil Co. of Texas, has been appointed division exploration superintendent in the company's eastern division, with headquarters in Lexington, Ky.

**L. T. Potter,** Dallas, superintendent of production for Lone Star Gas Co. and Lone Star Producing Co., has been made assistant general superintendent of both companies. He will perform his previous duties in addition to his new ones. Potter joined Lone Star in 1928, following his graduation from Texas A. & M. College with a degree in mechanical engineering.

**Arthur A. Steffan,** Oil City, Pa., has resigned as counsel and industrial relations representative of The Pennzoil Co., to become associated with Daniel A. Evatt, New York.

**John E. Tyson,** formerly a member of The Texas Co.'s geological staff, has joined Barnsdall Oil Co. as assistant to **J. D. Almer,** district geologist at Shreveport.

**H. R. Cullen,** independent oil operator of Houston, has given to University of Houston oil royalties valued at $4,600,000. This brings to $8,600,000 his known gifts to Houston institutions. Four hospitals previously received $1,000,000 each.

**George R. Gibson,** Richland Oil Corp., was chosen president of Midland (Tex.) Geological Society at its recent annual meeting. **Leo R. Newfarmer,** Shell Oil Co., Inc., was elected vice president; **Addison Young,** Phillips Petroleum Co., program chairman; **John J. Hill,** Union Oil Co. of California, secretary-treasurer.

**P. E. Lakin,** New York, vice president in charge of marketing of Shell Oil Co., Inc., has been elected a director. Lakin entered the company's service 30 years ago as a clerk in the Seattle office.

**Henry M. Brown** has resigned as director of natural gas and gasoline for District 3, Petroleum Administration for War, with headquarters in Houston. The resignation was effective March 31. On leave of absence as president of Midland Gasoline Co., Houston, Brown joined PAW September 29, 1943, with the understanding that owing to impaired health, he should serve a year only. His resignation had been pending since October 1944.

**Clarence S. Beesemyer** has been elected president of Gilmore Asphalt & Road Oil Co.; **W. G. Julier,** vice president; **D. H. F. McPherson,** general manager. This new company is successor to Gilmore Oil Co., whose marketing facilities were recently taken over by General Petroleum Corp.

**P. M. Martin** has resigned as head of Continental Oil Co.'s geological department in the Wichita Falls district of Texas to open an office as a consultant in that city. His place has been taken by **W. C. Northcutt,** transferred from the company's headquarters in Ponca City, Okla.

**H. Randall Harris,** Sun Oil Co. scout, has been elected first vice president of West Texas Oil Scouts Association, to take the place of **E. W. Dawson,** Seaboard Oil Co., who was promoted to landman in the Corpus Christi district.

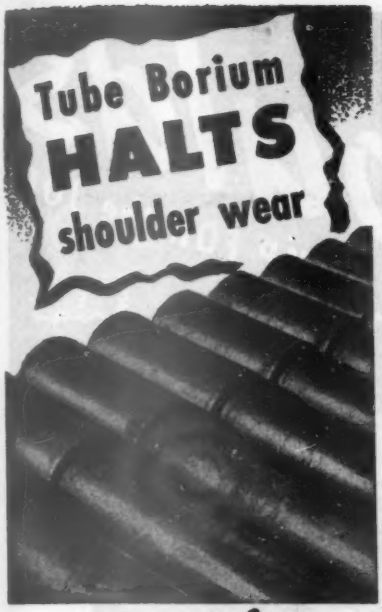
**Henry Hauseman,** traffic manager for Pure Oil Co. since October 1917, when he joined the company, has been promoted to the new post of general traffic manager. His headquarters will continue to be in Chicago.

**William R. Argyle,** Swarthmore, Pa., has resigned as associate director of the refining division, Petroleum Administration for War, to return to his former post as assistant manager of refining for Sinclair Refining Co., New York.

**Charles A. Mix,** regional geologist for the West Texas district of the Standard Oil Co. of Texas at Midland, was transferred to Tyler April 1 to head the geological department of a new regional office of the company. **J. S. Gibbs** from the Houston offices succeeds Mix at Midland.

**E. S. Bodine,** who was plant superintendent for the chemical division of Shell Oil Co., Inc., at the Torrance butadiene plant, has been advanced to plant manager of the same installation. **D. B. Luckenbill,** who was senior technologist, has been advanced to chief technologist.

**Earl Daniels** is to serve as chairman of the membership committee of the Los Angeles chapter of Nomads during 1945. At the first meeting of the year, held recently, the following foreign guests were introduced: **Florent H. Bailly,** Pantepec Oil Co. of Venezuela, Caracas, Venezuela; **George J. Betts,** Interna-

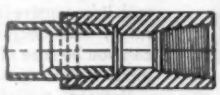



*Doubles* tool joint life

For fifteen years Tube Borium has been used on drilling bits to increase cutting speeds and drill more out-to-gauge hole. Now you can use this same alloy to greatly prolong the life of your tool joints!

An exceedingly small quantity of Tube Borium welded in a ring around the shoulder not only doubles tool joint life—even under the toughest operating conditions—but maintains over all joint strength and correct elevator contour. Applications are economically made on both new and resleeved joints.

**APPLICATION: Accepted method of application is to under-cut new or resleeved joints at the shoulder to form a recess ⅛" deep by 1½" wide. The recess is then filled by welding in with ⅜" Electric Tube Borium to form the wear resistant inlay.**



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**STOODY COMPANY**

**1138 WEST SLAUSON, WHITTIER, CALIF.**

STOODY HARD-FACING ALLOYS
*Retard wear... Save Repair*


tional Ecuadorian Petroleum Co.; **Orville W. Bryant,** formerly Australian Government oil-field operations; **Lt. J. R. Coleman,** U.S.N.R., formerly Mene Grande Oil Co., Venezuela; **Bob Harcus,** Burma Oil Co.; **Milton H. Hobbs, Paul Hughes, Charles M. LaMar,** and **Hobart L. LaMar,** all formerly New Zealand Petroleum Co., Gisborne, N. Z.; **R. L. Jewell,** Caribbean Petroleum Corp., Venezuela; **Alex Lae,** Trinidad Leaseholds, Ltd., Trinidad, B. W. I.; **Z. W. McCoy,** Colombian Petroleum Co., Cucuta, Colombia; **C. H. Strickland,** Standard Oil Co. of New Jersey (Egypt).

# CALENDAR

**April**

I.P.A.A., midyear directors meeting, New Orleans, La., April 16-18.

**May**

American Institute of Chemists, Medal meeting, Columbus, Ohio, May 11.

**June**

Interstate Oil Compact Commission, quarterly meeting, Oklahoma City, June 15-16.

Canadian Gas Association, annual convention, Manoir Richelieu Hotel, Murray Bay, Quebec, June 19-22.

**October**

Texas Mid-Continent Oil and Gas Association, Rice Hotel, Houston, October 4-6.

I.P.A.A., annual membership meeting, convention city to be selected later, October 15, 16 and 17.

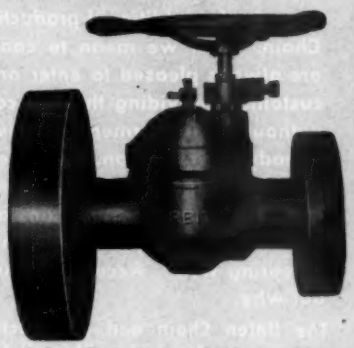
## LEGAL

U. S. DEPARTMENT OF THE INTERIOR, General Land Office, Washington, D. C. Notice is hereby given that the W½NW¼ sec. 34, T. 16 S., R. 29 E., N.M.P.M., New Mexico, 80 acres, within the known geologic structure of the South High-Lonesome oil and gas field, is offered as a single parcel to the responsible qualified bidder of the highest cash bonus per acre for lease under section 17 of the mineral leasing act, as amended by the act of August 21, 1935 (49 Stat. 674, 30 U.S.C. sec. 226). Sealed bids will be received in the office of the Commissioner of the General Land Office, Interior Building, Washington 25, D. C., up to twelve noon May 1, 1945. Each bidder must submit a certified check or cash for one-fifth of the amount bid payable to the order of the Treasurer of the United States and file the showing of qualifications to receive a lease required by section 7 of Circular 1386. The remainder of the bonus bid and the annual rental at the rate of $1 per acre must be paid, and a $5,000 corporate surety bond must be furnished by the successful bidder prior to the issuance of the lease. The deposits of the other bidders will be returned upon acceptance of the successful bid by the Secretary of the Interior. The envelopes should be plainly marked "Bid for lease, South High-Lonesome field, New Mexico. Not to be opened before noon May 1, 1945." No bids received after the hour fixed herein for submitting bids will be considered. The successful bidder will be required to agree not to discriminate against any employee or applicant for employment because of race, creed, color, or national origin and to require an identical provision to be included in all subcontracts. Bidders are warned against violation of section 59, U. S. Criminal Code, approved March 4, 1909, prohibiting unlawful combination or intimidation of bidders. The right is reserved to reject any and all bids in the discretion of the Secretary of the Interior. Fred W. Johnson, Commissioner.


ORBIT VALVES

**MASTER VALVE**
**WITH**
**UNEQUAL FLANGES**

The ORBIT GEAR OPERATED MASTER VALVE makes your Christmas Tree more compact by eliminating the use of an adapter flange—also eliminating chances for additional gasket leaks. The Unequal Flanges are cast integral with the body of the Valve.



*Orbit Gear Operated Master Valve*

This valve can be furnished thru all fabricators of Xmas Trees or thru any of your local supply stores at a price comparable to that of other leading valves, YET, this valve requires no lubrication to effect a seal.

**See 1944 Composite Catalog**

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**Earl F. Warren, Phone 919-W, Alice, Texas**
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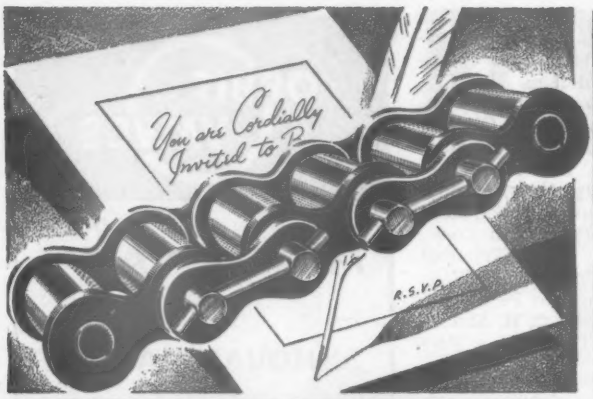


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☆ Certainly no one will construe this advertisement as an announcement of idle capacity for additional production of Oil Field Chain. What we mean to convey is that we are always pleased to enter orders from new customers providing that we can accept them without the impairment of deliveries on orders already in production. We believe you will be pleased with your choice whenever you buy Union Chain. Both our chains and our organization have a reputation with customers for "wearing well". Accept our invitation to find out why.

The Union Chain and Manufacturing Company
Sandusky, Ohio, U. S. A.

**Union Oil Field Chain for Every Application**

A. P. I. No. 3⅛ P Union *Superintendent* No. 3125-R
A. P. I. No. 3⅛ P Union *Superintendent* No. D-3125-R
A. P. I. No. 4 P Union *Jumbo* No. 1240-SXX
A. P. I. No. 4 P Union *Toolpusher* No. 1240-RXX
A. P. I. No. 4 P Union *Driller* No. 1240-R 4
A. P. I. No. 4 C Union *Roughneck* No. 1240-RX
A. P. I. No. 3 P Union *Toolpusher* No. 1190-RXX
A. P. I. No. 3 P Union *Driller* No. 1190-R 3
A. P. I. No. 3 C Union *Roughneck* No. 1190-RXS

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*Finished Steel Roller Chains and Sprockets*
All manufacturer's standard sizes ⅜ in. to 2½ in. pitch in single and multiple strands.

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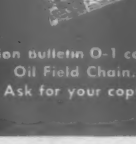

Union Bulletin O-1 covers Oil Field Chain. Ask for your copy.

UNION CHAINS

# Goulds

## the PUMP FOR the JOB

## DOING THE JOB AT ERATH!
## 14 Goulds Centrifugals Handle Tough Pumping Assignments

Fig. 3065—Eight of these 12" single stage double centrifugals are used.

Two 8" single stage double suction centrifugals are used.

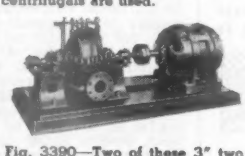

Fig. 3390—Two of these 3" two stage, opposed impeller centrifugals are used.

Fig. 3720—Two of these 2" single stage, enclosed impeller centrifugals are used.

Duties of these pumps range from 200 gallons per minute up to 5300 gallons per minute, from heads of 54 feet to 760 feet. Some of these pumps are driven by diesels, some by steam turbine and some by natural gas engines. Only from Goulds, specializing in pump building for almost a century, do you have such a choice of types, sizes, capacities. Only from Goulds, with its extensive line of centrifugal, rotary and reciprocating pumps, can you be sure of getting the right pump for your particular service.

Veteran operators at Erath as well as at many other refineries and pipe line stations, have learned through many years of experience with Goulds Pumps that they can be sure of efficient, long lasting, trouble-free service—no matter what the pumping duty—by selecting from Goulds complete line *the* pump for *the* job.

Goulds PUMPS INC.
SENECA FALLS, N. Y.

S. W. ROBINSON

F. R. HOADLEY

C. M. POWELL

J. E. KENNEY

J. J. DUFFY, JR.

WILL A. MORGAN

# Equipment Men in News

Davis-Dyke & Co., advertising specialists, Houston, Tex., announce the appointment of **Spencer W. Robinson** to its advertising staff. Robinson, formerly vice president and editorial director of Gulf Publishing Co.'s oil publications, recently resigned as director of public relations for the Petroleum Administration for War in Washington. Robinson is widely known in the petroleum industry. He was "drafted" by Petroleum Administrator Harold L. Ickes early in 1944 to serve as director of public relations for PAW. He directed the wartime job of keeping both the oil industry and the general public informed as to petroleum supplies. Robinson has been active in civic affairs in Houston and was associated with a group that organized and developed the council-manager form of government for the city. He was elected city councilman in 1942. He resigned from the council after 15 months of service to accept the PAW appointment in Washington. With Davis-Dyke & Co., Robinson will continue his association with the oil industry through contact with oil-equipment and service companies served by this company.

Farrel-Birmingham Co., Inc., of Ansonia, Conn., and Buffalo, N. Y., announces the election of **Franklin R. Hoadley** as president. Hoadley has been associated with the company since 1914.

**C. M. Powell** has been appointed Mid-Continent sales manager of International Derrick & Equipment Co., one of the Dresser Industries, it is announced by **Ferguson Barnes,** IDECO general manager of sales. He will be located at Dallas, the company's Mid-Continent headquarters. Powell joined **IDECO** in 1925 as district sales manager of Oklahoma, later assuming charge of sales in the Oklahoma, Kansas, Illinois, and Indiana division, and then being transferred to Dallas.

**J. H. Patterson** has been appointed manager of the Cummins Diesel Export Corp., subsidiary of the Cummins Engine Co., Inc., Columbus, Ind., manufacturers of heavy-duty diesels for automotive, marine and industrial service. Offices of the export corporation are located at 6303 Chrysler Building, New York 17, N. Y.

**Paul V. Osborn** has been appointed general factory manager of The Timken-Detroit Axle Co.'s Detroit operations, according to an announcement made by **R. J. Goldie,** vice president. Osborn joined Timken in August 1941, as assistant to the vice president.

**J. J. Duffy, Jr.,** has been appointed assistant manager of sales of Pennsylvania Salt Manufacturing Co., Philadelphia, Pa., according to **George B. Beitzel,** vice president in charge of sales.

**John E. Kenney** and **E. P. Goodrich** have been elected vice presidents of Foster Wheeler Corp. Kenney has been director of western offices with headquarters in Chicago since 1940. Goodrich has been associated with Foster Wheeler since 1912. He has been in charge of the turbine division since the formation of the company.

**F. Dale Bacon,** general manager of the Fire Extinguisher division of General Detroit Corp., announces the opening of a new branch and warehouse in Dallas, Tex. **S. M. Luce** has been appointed division manager in charge of this office.

J. H. PATTERSON

PAUL V. OSBORN

F. DALE BACON

At the annual meeting of The Lunkenheimer Co., Cincinnati, Ohio, the following officers and directors were elected: **Frank P. Rhame,** president and general manager; **Homer E. Lunken,** first vice president and assistant general manager; **Harry A. Burdorf,** vice president, sales; **Charles W. Burrage,** secretary; **Chester C. Isekeit,** treasurer and controller. Directors are **Harry A. Burdorf, Henry G. Frost, Chester C. Isekeit, Carl M. Jacobs, Edmund P. Lunken, Homer E. Lunken, Frank P. Rhame.**

**T. H. Wickenden,** manager of the Development and Research division of The International Nickel Co., Inc., announces the formation of the following newly created sections of the division: Industrial Chemicals Section to be headed by **O. B. J. Fraser;** Corrosion Engineering Section, with **F. L. LaQue** in charge, and Iron and Nonferrous Casting Section, headed by **Donald J. Reese.**

**John A. Tidball** has been engaged by Braden Steel Corp. of Tulsa as manager of the North Texas division of the company's activities. Tidball formerly was connected with International Derrick & Equipment Co. as sales engineer in various districts and in Latin-American development work.

Approval of a name change for The Eagle-Picher Lead Co. has been voted. **J. M. Bowlby,** president, announced that the company is to be known as The Eagle-Picher Co.

**John Howard Collier,** president of Crane Co., Chicago, Ill., was elected a director of the Allis-Chalmers Manufacturing Co., it has been announced by **Walter Geist,** Allis-Chalmers president.

General Controls Co., Glendale, Calif., manufacturer of electro-magnetic control valves, announces the completion of a processing plant, with 10,000 sq. ft. of space, in which the heat treating, anodizing, mechanical deburring, sand blasting and painting departments are housed. In addition, a new, modern office building will soon be ready for occupancy.

Chicago Bridge & Iron Co. has reopened its Los Angeles, Calif., office. It is at the same location, William Fox Building. The office is in charge of **Dean E. Stephan,** who for the past several years, has been assistant to **James C. Vosburgh,** manager of the Chicago Bridge & Iron's office in Washington, D. C.

**Will A. Morgan** has returned to his post as superintendent of the advertising department of Continental Oil Co., following 27 months' service as chief yeoman in the U. S. Navy. **Fred L. Hanks,** former assistant general sales manager of the company, who acted as advertising superintendent during Morgan's absence has been appointed to new position of superintendent of marketing analysis.

The Foxboro Co., Foxboro, Mass., announces that **William A. Rock** will be its resident engineer in the Corpus Christi, Tex., area, under the direction of the Houston office. **James M. Tuttle** has joined the staff of engineers attached to the Pittsburgh office of Foxboro at 5151 Baum Boulevard, Pittsburgh 24, Pa.

**John H. Odenbach,** president of the Odenbach Holding Corp., owners of Odenbach Shipbuilding Corp. of Rochester, N. Y., and Florida Shipbuilding Corp. of Miami Beach, Fla., recently established new offices at 21 West Street, New York, N. Y. Odenbach Holding Corp. will coordinate future sales activities of their properties and direct development of markets for new construction of all-welded steel vessels. **Edward A. Calderon,** formerly chief of the bunkers and ship stores section, bureau of supplies, Foreign Economic Administration, has been engaged to represent Odenbach Holding Corp. as Pan American representative.

The Dallas Advertising League has presented the Premier Award and the Award of Merit for the best advertising produced in Dallas in 1944 to Geophysical Service, Inc. The league in this way recognizes the outstanding advertisements of the year. The Premier Award is granted for the best advertising in any kind of medium, and the Award of Merit for trade-paper advertising.

# Classified Advertising

### FINANCING

CAPITAL SEEKERS—Interested in raising $25,000 or more for a legitimate project should write to AMSTER LEONARD, Fox Theater Bldg., Detroit 1, Mich.

### HELP WANTED

DRILLERS

Steady work, good wages, water wells year round, Bucyrus machines, essential to war effort, draft exempt. Apply — Gray Well Drilling Co., Inc., Box 181, Phone 1051, Delafield, Wisconsin.

ENGINEERS WANTED: Graduate Ch.E., M.E., or E.E., 20 to 29 years of age, having refinery or laboratory experience. Essential industry with post-war continuance. State education, experience, salary expected, and date of availability. P. O. Box 2546, Houston 1, Texas.

ONE OF the foremost producers of Industrial Wiping Cloths, both reclaimed and new materials, also mill ends, remnants, etc., is interested in assigning territory now to be ready for post-war operation. We are interested in the better type sales representative organizations now calling on the Industrial Trade. Advise particulars on manpower, territory and lines now carried. All replies will be treated confidentially. Box A-428, The Oil and Gas Journal, Tulsa, Oklahoma.

WANTED by consulting organization: Petroleum engineers with Hayward mud logging experience or its equivalent. Immediate openings in Venezuela, excellent opportunity for advancement to managerial positions throughout the world. Box A-290, The Oil and Gas Journal, Tulsa, Okla.

WANTED: Man from 30 to 40 years old to assist oil company executive, must be rapid stenographer, thoroughly experienced land department work oil business. Opportunity for advancement to capable, energetic party. Good salary. State fully experience and references. Address Box A-495, The Oil and Gas Journal, Tulsa, Oklahoma.

WANTED MAN: Knowledge of Map Drafting and Geology. Good free hand letter. Map room work. Chicago location. Give complete details first letter. Box A-496, The Oil and Gas Journal, Tulsa, Oklahoma.

SALESMAN: To contact oil trade in New York City for large Valve Manufacturer. Engineering experience preferred. Permanent position with good opportunities. State education, experience, salary expected and availability. Box A-499, The Oil and Gas Journal, Tulsa, Oklahoma.

## DRAFTSMEN

For Process Piping on Oil Refineries

**Applications solicited from men not now employed in essential work or those completing essential work who have Statements of Availability**

ARTHUR G. McKEE & CO.
2300 Chester Avenue
Cleveland, Ohio

**Ashland Oil & Refining Company, Ashland, Kentucky**

**WANTS**
**DESIGNING DRAFTSMAN**

With experience in oil refinery and power plant piping, pressure vessels and heat exchangers. Independent company with completely integrated operations and a large output of 100 octane gasoline. Due to postwar program this position offers excellent opportunities for the future.

Address all correspondence to Employment Department. Applicants must comply with War Manpower Commission Regulations.

### HELP WANTED

ENGINEER for field consultation and sales work, by manufacturer of refinery and power plant equipment. Age 25 to 35. Excellent future prospects. Box A-501, The Oil and Gas Journal, Tulsa, Oklahoma.

EXPERIENCED production superintendent for Kansas. Good position for the right man. State experience, age, and salary expected first letter. Box A-493, The Oil and Gas Journal, Tulsa, Oklahoma.

**MEN FOR FOREIGN EMPLOYMENT**
**in Saudi Arabia**

Refinery operators; petroleum, electrical and mechanical engineers; radio operators and technicians; air-conditioning and refrigeration mechanics; stabilizer operators; welders (pressure-vessel-pipeline); stenographers; typists.

Employment offers opportunities for post-war security and advancement. Liberal benefit plans; vacations in United States; free hospital and medical care.

If genuinely interested in foreign career, send full information on experience, transcript of college record (professional applicants only), references, draft and availability status to our Employee Relations Department.

**ARABIAN AMERICAN OIL COMPANY**
200 Bush Street
San Francisco 4, California

### SITUATIONS WANTED

EXPERIENCED gas distillate production and plant man with long administrative and supervisory background desires change. Box A-485, The Oil and Gas Journal, Tulsa, Oklahoma.

ACCOUNTANT, oil drilling, refining and production experience. Some public accounting experience. Box A-451, The Oil and Gas Journal, Tulsa, Oklahoma.

GEOPHYSICIST: Twelve years laboratory and field experience in all phases seismic prospecting, from technician to party chief. Age 37, draft deferred. B.S. degree in electrical engineering. M.S. in physics. B.A. in geology. Interested in employment in geophysical or production departments, not requiring continuous change of residence. Box A-453, The Oil and Gas Journal, Tulsa, Oklahoma.

ELECTRICAL and instrument man, 17 years experience in refining and construction. Capable of the planning, installation and maintenance of electrical and instrument equipment, including power plants and motor winding. Recommended by all leading instrument manufacturers. Available April 20, 1945. Box A-486, The Oil and Gas Journal, Tulsa, Oklahoma.

LAND and TITLE MAN: Have handled all office details and done buying and curative work in the field. 14 years experience with majors and independents. 37, married, 4-F, available. Box A-490, The Oil and Gas Journal, Tulsa, Oklahoma.

PRODUCTION Superintendent, 40 years old, with more than 20 years practical experience in all phases of the oil producing business, desires connection with small progressive company. Box A-494, The Oil and Gas Journal, Tulsa, Oklahoma.

WANTED: Position as superintendent of small refinery. Eighteen years experience in various operational positions, including twelve years operation on topping, cracking, vacuum, and reforming. Some treating. Now employed as an operator. Age 37. Box A-498, The Oil and Gas Journal, Tulsa, Oklahoma.

SALES Engineer having outstanding contacts with major engineering concerns in the East desires acting as manufacturers representative of well established products. Box A-500, The Oil and Gas Journal, Tulsa, Oklahoma.

### EQUIPMENT WANTED

WANTED TO BUY: 1 Wilson pulling unit, mounted on truck, unit to be capable of pulling tubing in 6 to 7 thousand feet wells. Quote price and full description and location of machinery. LOUISIANA IRON & SUPPLY COMPANY, Shreveport, Louisiana.

### EQUIPMENT WANTED

DOUBLE Drum Oil Well Servicing machine with Spudding Attachment. Address Oil & Gas Co., 1702 Transit Tower, San Antonio 5, Texas.

**WANTED**
**2½ INCH PIPE**
Also other sizes of pipe and tube
Write, wire or phone
**SONKEN-GALAMBA CORP.**
Kansas City 18, Kansas.

### EQUIPMENT FOR SALE

FOR SALE: Two Waukesha Drilling engines, 180 H.P. equipped with gasoline starting motors. R. L. Melton, Seminole, Okla.

FOR SALE: New 394′ 6″ 23.50# 8 Thd. Emsco Screen Pipe. New 209′ 5⅛″ 17# 10 thd. Inserted Emsco Screen Pipe. New 4¼″ 13.75# 10 thd. Emsco Screen Pipe. E. E. Eversole, Box 386, Healdton, Okla.

LUMBER FOR SALE: 3x6 & wider Bridge Plank. 2x4 & wider S4S oak & gum. Oak surveyor stakes. E. J. Gaiennie, Box 1074, Shreveport, La.

FOR SALE: One 4000′ OCS Model well servicing machine mounted on D-40 International truck, with telescoping pole. The truck and machine in perfect condition mechanically and looks. Excellent rubber. Machine factory mounted and equipped. Also three 800 watt Kohler light plants in first class condition. W. H. Bass, Fairfield, Illinois.

9—300 bbl. ¼″ new plate throughout stock tanks. Haddock Tank & Mfg. Company, Tulsa, Oklahoma.

1—Wilson Mogul Compound Rotary Drilling Rig, complete with or without Lee C. Moore Mast. 1—Cardwell Rotary Drilling Rig complete, Lee C. Moore Mast, both rig diesel powered and in A-1 shape. Neal Simmons, 209 First National Bank Building, Mt. Vernon, Illinois.

**RELAYING RAILS**

12#—exceptionally good quality

**RAILROAD TIE PLATES**

for all size rails. All in good condition. For complete details, contact

**SONKEN-GALAMBA CORP.**
Kansas City 18, Kans.

**FOR SALE OR TRADE**

4200 ft. 9″ O.D. 40# Grade D casing just pulled from 6500′ well. Want exchange for 7″ O.D. string casing to use in well. Edmond, or will sell at ceiling price. J. Lynn Overlees (owner). Tel. 845 Edmond; Box 4057 Cap. Hill Sta., Oklahoma City.

**NATURAL GAS ENGINE**

Waukesha-Mod. H. L. 47G, Serial No. 439564, 4-cylinder, 6″ bore x 6½″ stroke, rated 65 H.P. at 1050 R.P.M., complete with twin disc clutch, radiator, and fan, rails, 12-volt electric starting motor and generator, safety device, gas valves, 12-volt batteries and spare parts. Engine just overhauled and in A-1 condition. Write, wire or phone—

**PATTEN TRACTOR & EQUIPMENT CO.**
1056 North Kolmar Avenue
Chicago 51, Illinois
Telephone—Belmont 1240

**FOR SALE**

1—#401 THD National Pumping Unit with second well attachment.
1—#00C 4-cylinder Hercules engine for above.
8—40 HP Superior Gas Engines.
12—Parkersburg standard steel rig fronts with weights.
5—84 foot and 1—96 foot steel derricks.
4—122 foot steel drilling derricks (Parkersburg). 333,000 lbs. cap.
1—122 foot American steel derrick with 4″ relegs. 400,000 lbs. cap.
50,000 feet of 2½″ upset seamless tubing.
11,000 feet of 3½″ OD upset seamless tubing.
8,000 feet of 5½″ OD 20# seamless casing.

**HERMAN KAISER PIPE & SUPPLY COMPANY**
816 Palace Building Phone 3-34[illegible]
Tulsa, Oklahoma